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Abstract

This report examines the effects of investment in transportation, telecommunication, and water and wastewater infrastructure on improving the economies of rural America. The authors leave the reader with a healthy degree of skepticism about the possibility of the direct stimulation of economic development across the spectrum of rural communities through just any infrastructure investments. On the other hand, the three agree that certain carefully selected infrastructure investments may often have good economic development payoffs, when these investments are made in places with the other prerequisites for development.

Keywords: Transportation, telecommunications, water supply, wastewater, rural development, infrastructure, economic development

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Foreword

This report examines investment in physical infrastructure as a strategy to promote rural economic development. It is one of four reports on the effectiveness of selected strategies that governments can use to stimulate such development. Other reports will examine strategies centered on education and training, financial market intervention, and encouragement of private business investment.

For the purposes of our analysis, the central goals of rural development are raising rural incomes toward the national average and helping preserve threatened rural communities. In this series, the effectiveness of each rural development strategy is measured by its chance of success in advancing either or both of these goals.

These reports are intended to support policymakers with timely economic analysis of rural issues. Like *Rural Economic Development in the 1980's: Prospects for the Future* (RDRR-69), the comprehensive collection of studies on rural conditions and economic characteristics published in 1988, this current set of reports reflects ERS's efforts to sharpen the focus of its research and make it more useful and accessible to policymakers and their staffs.

Important rural policy issues are now on the agendas of the Executive Branch and Congress. The President's Economic Policy Council and the Secretary of Agriculture have expressed strong interest in rural development. The President has issued a rural policy statement, and the Secretary has set in motion a review of USDA's rural mission, aimed at sharpening the Department's focus. In Congress, rural development bills, very different in form and content, have passed the Senate and the House of Representatives. Rural development has also been linked with success by the foreign ministers of the world's developed nations in the Uruguay Round of negotiations on the General Agreement on Tariffs and Trade. In these negotiations, the main participants have agreed, in principle, to reduce agricultural protection, considered by most countries as the chief form of governmental assistance to rural people. Finding a new and better way to help rural areas develop economic opportunities for their people is regarded by some as a necessary precondition to giving up agricultural protection.

The poor performance of the U.S. rural economy during most of the 1980's lies behind much of the current policy concern in this country, and similar trends are apparent in other developed countries. Following a historically unprecedented rural renaissance in the 1970's, most of America's rural areas

were hit hard by and recovered slowly from the 1980-82 recession. Although there is evidence of an upturn in the last few years, the 1980's was a dismal decade for most rural areas by virtually every measure. Rural per capita income declined in real terms and in relation to urban per capita income. New jobs were created at a much slower pace, and real earnings per job declined absolutely. Unemployment rates rose faster and higher, and stayed at recessionary levels longer. At one point in the decade, the poverty rate was 35 percent greater than in metropolitan areas. And more than half the nation's rural counties lost population in the 1980's.

Each report in this series contains chapters exploring various aspects of one broadly defined rural development strategy. They review previous social science research and present new analysis. They do not evaluate specific programs. Rather, the objective of the series is to describe the probable consequences of adopting a broad approach, including its effectiveness, limitations, and unintended effects.

As in the whole series, the authors of this report used their own methods of analysis and reached their own conclusions. David W. Sears, Thomas D. Rowley, and J. Norman Reid provided overall guidance to the authors of the individual chapters, as well as writing the overview chapter. Other ERS researchers and analysts outside the agency also reviewed and commented on some or all of the chapters.

Rural development goals are numerous and diverse. They include reducing the gap in incomes and standards of living between rural and urban people, protecting threatened rural communities, attacking extensive and persistent poverty in certain rural areas, preserving the rural character of some areas, helping the family farm survive, contributing to overall national economic well-being, and conserving natural resources and the environment.

Some of these goals are independent, some mutually reinforcing. But in practice, progress toward one goal often seems to come at the expense of others. Examples are numerous. Farmers' average real incomes rose over the last decades, to the point that they are actually higher than other rural people's incomes and close to the national average. But, so many people left farming that fewer people share the sector's earnings. The structural changes that increased average farm income--fewer, larger farms--were unwelcome to those who prefer a sector made up of small farms. The same changes in the sector also reduced viability for many farm-dependent rural communities. Similarly, new employment opportunities that make a rural community more vital sometimes create environmentally damaging and aesthetically displeasing sprawl. And new jobs that make a community stronger may not reduce urban-rural income disparities if they pay low

wages. Unless the poor share in the job growth, which many cannot because of age or physical disability, development will not reduce poverty.

Almost any strategy will succeed by some criteria and fail by others. Analysis that does not measure a strategy against a specified set of key goals may identify many benefits but not contribute much to the policymaker's search for the best means of achieving these goals. Therefore, we have chosen to define rural economic development by what seem to us its two broadest and most widely held goals: increasing incomes and promoting community strength.

Acknowledgments

Many people, in addition to the authors, contributed to this report and others in the series. A committee made up of Richard Long, David McGranahan, Tom Hady, Herman Bluestone, Katherine Reichelderfer, Sara Mazie, Norman Reid, and Patrick Sullivan planned the series. David W. Sears, Thomas D. Rowley, and J. Norman Reid guided and coordinated the preparation of this report. David McGranahan, Patrick Sullivan, and Norman Reid performed similar work for other reports in the series. For the entire series, Lindsay Mann provided editorial guidance, and Joseph Lockley provided production assistance. Dominique Harris provided production assistance for this report.

Although final responsibility for the contents rests with the authors, like most research in the Agriculture and Rural Economy Division of the Economic Research Service, many of the concepts and some of the analysis used in this series are drawn from a base built by colleagues. That base is too interwoven and has been created by too many researchers over too long a period to allow full recognition for each contribution. Most notable in that group, however, are Calvin Beale, originator of many of the ideas and approaches echoed in all ERS's rural development studies, and Kenneth Deavers, Director of the Division, who has guided the ERS rural development research program intellectually, as well as administratively, for many years.

Richard W. Long, Associate Director
Agriculture and Rural Economy Division
Economic Research Service
U.S. Department of Agriculture

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Chapter 1

Infrastructure Investment and Economic Development: An Overview

David W. Sears, Thomas D. Rowley,
and J. Norman Reid*

Introduction

This chapter, and the three which follow, discuss the contribution of infrastructure investment to rural economic development. Does infrastructure investment contribute to rural economic development? If so, how and to what extent does it contribute? This chapter provides an overview of the topic by defining terms, examining key issues, and exploring relationships. Each of the following chapters examines the contribution of a specific type of infrastructure investment--namely, transportation, telecommunications, and water/wastewater--to rural economic development.

Definition of Infrastructure

For purposes of this work, we define **infrastructure** as "the permanent physical installations and facilities supporting socioeconomic activities in a community, region, or nation"(9).¹

This infrastructure is generally characterized by high fixed costs and a long service life. While much of this infrastructure is in the private sector (such as manufacturing plants), this volume will focus on that portion of the infrastructure that is public (such as highways) or is under substantial public control or regulation (such as telephone systems).

* The authors are all in the Agriculture and Rural Economy Division, Economic Research Service, U.S. Department of Agriculture. Sears is head of the Government and Development Policy Section. Rowley is a social science analyst. Reid is deputy director for rural development.

¹ Italicized numbers in parentheses identify literature cited in the References at the end of this chapter.

The Importance of Infrastructure to Rural Communities

There are several plausible justifications for making infrastructure investments in rural areas. First is the frequently cited argument that infrastructure investments and the services they support are important for stimulating economic development within rural communities. Many rural development programs have been designed with infrastructure strategies at their core. In addition to economic development, however, other justifications have been made to support rural infrastructure investments.

Second, many types of infrastructure, such as water treatment systems, hospitals, and fire stations, are needed to protect and promote the health and safety of rural residents. Without such key infrastructure investments, most of which are within the public sector, public health and safety could be seriously jeopardized.

Third, many other facilities support services that make life more convenient and pleasant. These include parks and recreation facilities, libraries, and museums and other cultural facilities, especially in larger communities.

The provision of services that enhance living conditions in a community--by promoting public health and safety or by making life more pleasant and convenient--may indirectly improve the economic development prospects of the locality by increasing the area's attractiveness as a place to live and work.

The central issue covered in these chapters is the nature and extent of the economic development role, if any, of infrastructure investment. Policymakers often have looked upon infrastructure investment as a major mechanism for improving the economies of rural America. One should remember, however, that some infrastructure investments, even when not justified by their economic development effects, will still make important contributions to other aspects of life in rural communities. Economic development is not the only reason for infrastructure investment, but it is the one that we will focus on in this volume.

Estimates of Rural Infrastructure Need

The case for infrastructure investment as an economic development strategy rests on the assumption that, without such investment, a shortage or bottleneck will prevent, or at least restrain, development. Thus, a key piece of analysis is to determine the extent to which infrastructure shortages--in both quality and quantity--exist.

For nearly a decade, the Nation has undergone a major debate concerning the quality and quantity of its infrastructure. Much evidence has been assembled to demonstrate important public service needs in a number of areas, but the issues are complex and a fully convincing case is hard to make.

A typical conclusion can be found in the provocatively titled volume *America in Ruins*: "America's public facilities are wearing out faster than they are being replaced. The deteriorated condition of the basic public facilities that underpin the economy presents a major structural barrier to the renewal of our national economy"(3). Four major studies conducted in the 1980's developed estimates of the **annual** infrastructure investment needed in the United States; these estimates range from \$59 billion to \$141 billion.²

One particular basis for concern is the declining rate of infrastructure investment. In 1988, the National Council on Public Works Improvement (NCPWI) concluded, after a 2-year study, that "the quality of America's infrastructure is barely adequate to fulfill current requirements, and insufficient to meet the demands of future economic growth and development"(13). A major piece of evidence that the NCPWI uses to support its gloomy conclusion is the declining percentage of national resources devoted to infrastructure over the past two decades. In the early and mid-1960's, total annual infrastructure expenditures exceeded 3.5 percent of GNP, but by the mid-1980's these had declined to slightly more than 2.5 percent. Even more pronounced is the decline in capital expenditures for infrastructure, which dropped from nearly 2.5 percent of GNP in the early and mid-1960's to less than half that by the mid-1980's.

This information by itself is not convincing, however. As one observer points out, "taken together, these pieces of objective evidence are not sufficient to conclude that the nation is underinvesting in infrastructure since it is possible that there was a surplus of infrastructure available nationally in the 1960's" (19). Furthermore, lower rates of public infrastructure investment in the 1970's may be explained by two phenomena of the late 1960's: "the baby boom worked its way through the school system, reducing the need for school construction, and the Interstate Highway System neared completion" (10). Hulten and Peterson found no overall decline in the **performance** of public infrastructure and concluded that "no evidence has been advanced to show that deterioration of public capital has significantly influenced the productivity of the nation's private sector as a whole."

² These four estimates were prepared by the Associated General Contractors (\$141 billion), the Congressional Budget Office (\$59 billion), the Joint Economic Committee (\$64 billion), National Council on Public Works Improvement (\$90 billion) (15).

Analyses of the need for infrastructure investment have been complicated, and made less useful for our purposes, by their failure to deal separately with the three different justifications for such investment. No study has estimated the level of infrastructure investment needed to sustain a certain level of economic activity (such as the investment level necessary for the United States to remain competitive with Japan and Europe or to maintain our post-World War II growth rate). Instead, these studies' estimates of infrastructure investment needed to achieve economic development objectives have been entangled with estimates of the infrastructure investment needed to achieve health, safety, and convenience objectives.

Assessing the need for public infrastructure in rural America is even more difficult. The most recent and comprehensive national survey of rural public facilities, conducted in 1981, found that the basic public infrastructure one would expect to find in any U.S. locality, such as paved roads and safe drinking water, was available in most rural locations (16). Rural communities totally lacking in essential facilities were most often very small unincorporated areas without a sufficient population base to support even the most basic infrastructure. Some evidence of aging or deteriorating rural facilities was reported, but the study was unable to determine the exact magnitude of the rehabilitation or new construction needed.

Whether America as a whole and rural America in particular need to increase the rate of investment in infrastructure remains a critical question. Much attention has been devoted to the subject, but the sum of the evidence about the need for infrastructure investment is inconclusive.

Infrastructure as a Stimulus of Economic Development

According to some theories, infrastructure investment might stimulate the economic development of a rural region in up to four ways.³

First, providing a new facility or upgrading the quality or quantity of local infrastructure may enable local firms to expand their existing activities or improve their efficiency. For instance, improving the quality of the local phone service might allow businesses to more easily establish computer links with suppliers and distributors, leading perhaps to a faster response time, an

³ Some theory supports looking at the infrastructure-economic development relationship as a two-way street. For this volume, we are interested only in the economic development that is stimulated as a result of investment in infrastructure. Other literature, however, focuses on the demands for additional or upgraded infrastructure facilities that emanate from continuing economic development (11, 19).

expanded set of goods or services offered, fewer errors on orders, and ultimately resulting in more customers. As another example, opening a new four-lane highway from the community to a nearby Interstate highway may reduce the distance (in time) to the closest metro areas; this investment might be expected to promote development by improving efficiency through reduced transportation costs and shipping times. The theory holds that improvements in the quality or quantity of infrastructure will often enable business to be transacted more efficiently and more reliably than before. The costs of doing business should drop in relation to the revenues generated, and the productivity of the local economy should increase.

Many needs studies are based either explicitly or implicitly on the assumption that a strong infrastructure will lead to strong economic development. But, what is the evidence to support such a contention?

One student of the infrastructure-economy link concluded that "as much as 60 percent of the productivity slump in the United States can be attributed to neglect of our core infrastructure" (1, 6). The high correlation found between productivity levels and public infrastructure investment levels in seven industrial nations during 1973-85 reinforces the concept that investment in infrastructure is tied closely to economic development (2).⁴ A recent study of the creation of jobs by new firms concluded that one of the "most important and effective contributions governments can make to new firm births and prosperity...[is] provision of a **reliable** infrastructure"(17). Still another study examined infrastructure investment data from 40 metro areas during 1904-78. The authors concluded that public infrastructure investment does lead to economic development (5). There is, then, some support for the theory that infrastructure investment will promote economic development by improving the productivity of the local economy.

A second often-cited reason for expecting economic development to result from infrastructure investment is that construction jobs are created as infrastructure is built or rehabilitated. This expectation neglects the fact that these jobs will be only a temporary stimulus to the local economy. While stimulating some short-term economic growth, these temporary jobs do not improve the economy's long-term capacity; the creation of such construction jobs does not, therefore, meet our definition of economic development. Nevertheless, local officials often overstate the benefits of this immediately apparent, but not enduring, economic stimulus.

⁴ Also see Whitelaw and Niemi (22).

Third, investments in infrastructure that lead to improving the health, safety, convenience, and general ambiance of a community often have some indirect economic development payoffs. Thus, a locality that is made a more attractive place to live and work through selected infrastructure investments may become a more likely setting for economic development.

Fourth, many infrastructure investments, especially those of a substantial scale or that are highly visible, may boost community morale. This psychological lift can create a climate that encourages other investments, leading ultimately to economic development. For instance, even if they have no direct effect on the productivity of local firms, investments such as the opening of a new convention center or airport could give a rural area a new burst of optimism about the health of the local economy that might stimulate investments that would otherwise not occur.

A significant time lag, usually a number of years, separates the initial concept of facility construction or upgrading and the resulting economic development effects of an infrastructure investment. This time lag occurs, in part, because of the typically long time from project proposal through planning, financing, final approval, and construction. Thus, even construction-related effects and the psychological boost from an infrastructure investment may take years to be felt.

Even after the project is built and in use, its full effect may take many more years to be achieved. Because most resources and economic activities are somewhat immobile in the short run, only a few resources and activities will move immediately in response to an improved infrastructure. One would never expect, therefore, that infrastructure investment could be a "quick fix" solution to an economic development problem.

Three possible situations exist with respect to the importance of infrastructure for economic development. First are situations where infrastructure investment is both **necessary and sufficient** for stimulating economic development. Second, we could find situations in which infrastructure investment is **necessary but not sufficient** (for example, rehabilitating an old sewer system is necessary for business expansion, but without key technical information, local businesses will be unable to make effective investment decisions). Third are situations where infrastructure investment is **not necessary**, either because some noninfrastructure element (or elements) is the only impediment to stimulating economic development, or because no element (neither infrastructure nor noninfrastructure) nor combination of elements will be sufficient to stimulate the area's economic development.

Whether infrastructure investment is likely to lead to economic development largely depends upon which of these three situations exists in a given setting. Little is known, however, about the relative frequency of these situations; thus, our picture can only be based on the informed opinions of expert observers.

The suspicion is that there are few, if any, clear-cut real world cases of the **necessary and sufficient** situation. An infrastructure investment, single-handedly, will probably not lead to economic development. Fox concludes that "no one infrastructure investment can guarantee development" (8).

We suspect that the **necessary but not sufficient** situation will be found at least occasionally, if not more often. Thus, numerous cases probably exist where investments to fill gaps in a locality's infrastructure, made in conjunction with other community investments (such as training specific segments of the labor force or improving the delivery of technical assistance to local businesses), do lead to economic development (4).

We will also probably encounter the **not necessary** situation frequently. In many instances, there may be no good economic development rationale for an infrastructure investment, although there may be health, safety, or convenience justifications for such investments. Fox observes that "insufficient infrastructure is unlikely to be a constraint on growth in places that have few other prerequisites to growth..." (8).

Key Variables

Many variables, several of which we discuss below, will influence the nature and extent of the likely economic development effects of an infrastructure investment. Some of these investments, under certain conditions and in certain circumstances, will increase the probability of economic development sufficiently to be worthy of implementation, while others will not (8).

Metro vs. Nonmetro Location

Metro and nonmetro areas differ on several dimensions, including population density, demographic features, and economic characteristics. As a result, one might reasonably expect metro-nonmetro differences in terms of the precise nature of the infrastructure-economic development relationship. For instance, there is no reason to expect that airport improvements will have the same economic development effect in a small

rural county as in a metro area. What is a critical investment in one case may be a low-impact investment in the other case.⁵

The entire focus of this volume is on the effect of such investments in nonmetro America. Hite notes that the infrastructure problem may or may not be more **severe** in nonmetro areas compared with metro areas, but it is certainly a somewhat **different** problem. In enumerating some of the major differences, Hite states that "if rural communities may have less resources with which to construct, maintain, and operate infrastructure, that disadvantage is partially offset by having less need for certain types of infrastructure than congested urban communities.... In counterpose, it should be noted that sparse population can increase the unit costs of both constructing and operating certain types of infrastructure" (9).

In addition to metro-nonmetro differences in economies of scale, types of facilities required, and availability of fiscal resources, there are also differences in the professional and technical skills available to plan and operate infrastructure facilities. The relatively low skill levels found in many rural communities put them at a disadvantage in terms of attempting to operate their facilities to achieve minimum costs or maximum benefits. One way to reduce this skill-level differential would be to establish an infrastructure extension service which would focus upon the needs of smaller, mostly rural communities.

Intraregional Location

The specific intraregional location of an infrastructure investment can have two types of economic development implications. First, infrastructure development in one part of the region might boost economic activity in that area but not elsewhere in the region. For example, a new water system might be located in a town in one corner of the area, producing economic benefits in and near the town but not affecting the remainder of the region. Second, one location may be better than another for the economic development of the region as a whole. For instance, location of a new community college in a small town with two existing colleges and several small manufacturing plants may build on an agglomeration of skilled personnel in that town, producing much greater regional economic benefits

⁵ In this example, one can imagine good reasons for the advantage to go either way. One could reason that upgrading a small rural airport could significantly affect the local economy, but a comparable improvement in a metro airport might have only a marginal effect. On the other hand, one could reason that in a vibrant metro economy, any facility upgrading would increase the area's capacity to conduct business, while in a stagnant rural economy no improvement is likely to have much of an effect.

than would occur had that new college been located elsewhere, in a more isolated setting; this approach is supported by the growth pole theory.⁶

Existing State of Infrastructure

Communities do not all begin at the same point in terms of the state of their existing infrastructure, seen as a combination of both quantity and quality. A locality in which the infrastructure is already adequate, in terms of both quality and quantity, may continue to provide the necessary infrastructure for economic development simply and relatively cheaply by maintaining its existing facilities so that they retain their original characteristics. In contrast, a community with severely inadequate infrastructure will have to invest substantially in new construction or major rehabilitation, or both, to provide facilities with a comparable ability to support economic development.⁷ Thus, the ease with which a community can provide infrastructure of a certain quality/quantity level, and the costs, will clearly vary with the community's starting point.⁸

The existing state of infrastructure in most communities in rural America has been dramatically improved over the past 50-75 years. Thus, today there are few localities where the infrastructure deficiencies are huge, significantly restraining economic development. The stereotypical rural community of the post-World War I era with no paved roads, no telephones, and no electricity is largely a phenomenon of the past. Its memory may linger on in the popular mind, however, when we think about the existing state of rural infrastructure. The situation in today's rural communities is less stark than this out-of-date stereotype, but is perhaps more complex to unravel.

⁶ The growth pole theory holds that to most efficiently promote economic development in a region, resources aimed at development should be concentrated at one (or a few) carefully selected locations--called "growth poles"--rather than spread evenly or randomly or haphazardly across the region (12, 18, 21). The importance of the growth pole theory depends upon one's reference point. If the theory is accurate, then from a national, State, or regional perspective, the precise location of an infrastructure investment will substantially affect the economic development results. From the local point of view, however, the key question is whether the investment is to be made in **my** locality (if so, I like it; and if not, I don't).

⁷ Within the general realm of infrastructure investment, one can also speak of planned **disinvestment** in infrastructure, which occurs by closing or downgrading existing facilities whose operation at current levels is no longer justified.

⁸ Through carefully conceived demand management, a given state of infrastructure can often be used more effectively, increasing the productivity of the local economy without making investments to improve the quality or quantity of the infrastructure.

Industrial Composition

For certain economic activities, perhaps including industries with relatively unsophisticated transportation and telecommunications demands, economic development may require only a basic level of infrastructure. Other economic activities, perhaps including industries with specialized transportation or telecommunications demands, probably need a much higher minimum level of infrastructure to encourage or sustain economic development.⁹

Improvements in the existing state of infrastructure in a given community, say one in which the existing industrial structure contains low-infrastructure-demand industries exclusively, might move the locality from below to above the threshold level required by high-infrastructure-demand industries. These investments might have a substantial longrun payoff in stimulating local economic development by enabling high-infrastructure-demand industries to operate in the area. (This conclusion assumes that the other preconditions for developing high-infrastructure-demand industries are present.)

Whether a community is focused mainly on low-infrastructure-demand or high-infrastructure-demand industries, infrastructure improvements that move the locality beyond the minimum threshold might also have positive development effects. Beyond some point, however, any addition to quality or quantity may stimulate no additional economic development.

The main point that we wish to make here is that different industries will have different infrastructure demands. Some improvements in the state of infrastructure might produce large changes in the likelihood of local economic development. In other communities with somewhat different industrial mixes, the same improvements might result in little or no change. Therefore, if a community's infrastructure is to serve its present industrial structure, but not provide facilities far beyond its current need, in terms of quantity or quality or both, then careful recognition of that industrial composition is necessary. If a community is attempting to modify its current industrial base, however, then explicit consideration of the different infrastructure demands of that desired future set of industries is critical.

⁹ Fox states that "knowledge of whether infrastructure beyond a minimum level will increase development is the key for judging whether investments in new infrastructure should be used as a development tool" (8).

Characteristics of the Community

Several community characteristics are critical in determining the likely economic development impacts of infrastructure investments. In some situations, a rural area may possess a number of positive developmental resources--such as entrepreneurial vision, raw materials, skilled labor, and the availability of strong technical assistance--and only lack a specific infrastructure facility. In such a case, providing that facility could stimulate substantial economic development activity. A comparable investment in a different community without a solid developmental foundation might, in contrast, produce no economic development results. Other key community characteristics include some already described above, such as the existing state of the infrastructure and the industrial composition of the economy. The likely economic development effects of a proposed infrastructure investment cannot, therefore, be evaluated outside the context of the community in which it is to occur.

Fox reminds us that "determination of the communities with the highest payoff is complicated because changing economic and demographic structures will alter the dynamics of growth so that those places and industries with the greatest potential at one point in time may not be at another" (8).

Type of Infrastructure Investment

There is no reason to expect that investments in transportation, water and wastewater, telecommunications, and other types of infrastructure will be equally effective in stimulating economic development. On the contrary, one might expect that different types of investment would probably have different types of economic development effects. Deno has found such differences. He concludes that "there are large differential effects across regions and categories of public capital" (4). A major objective of the following three chapters is to shed some light on these differences.

National vs. Local Perspective

The world can be viewed from several different vantage points. Sometimes what you see depends on where you stand. Thus, a particular infrastructure investment may lead to positive economic development results for the local area but negative results for the Nation as a whole. For instance, providing new water and sewer capacity in a small Texas town may contribute to the economic development of the town, but from a national perspective may only cause development to be moved around from other locations where it would have occurred otherwise. Thus, from the national viewpoint, the

results would be negative when the costs of the water and sewer construction are weighed against no economic development benefits.

Short-term vs. Long-term Perspective

The economic development payoffs from an infrastructure investment can be measured over any time period that one chooses. No particular time horizon is mandated. But the time horizon chosen can make a difference. For instance, an investment that may lead to a gradual increase in economic development over a multiyear period would be seen as having virtually no shortrun economic development payoffs, but strong longrun payoffs.

Concluding Point

Perhaps the single most important point to emerge from the preceding examination of key variables is that numerous factors that may be critical to the success or failure of an infrastructure investment's ability to stimulate economic development will vary from community to community. Therefore, place-specific analysis of infrastructure investments aimed at promoting economic development is not only appropriate, it is mandatory.

The Next Three Chapters

Many infrastructure investments can be made in rural areas, but we have selected just three types of facilities to examine in more detail: transportation, telecommunications, and water and wastewater investments.

The choice of these facility types was based on three criteria. First, they are commonly believed to have the greatest potential effect on rural economic development. Second, they have been featured prominently in recent rural development legislative proposals. Third, they involve a substantial degree of control by the public sector.

Caveats

Although we look at these three facility types one at a time, there are some severe analytic consequences of doing so. First, when one examines the economic development effects of infrastructure investments, the whole may be greater than the sum of the parts. That is, two or three carefully selected infrastructure investments made simultaneously may stimulate more economic development than they would if made separately. Deno found that this summation effect was true when he examined the manufacturing sector (4). It may be more generally true as well.

Furthermore, infrastructure investments interact in complex ways with other investments (such as training and technical assistance) aimed at stimulating economic development in rural areas. For example, the combination of two investments—one in infrastructure and one in another type of investment, such as education—may provide a substantially stronger basis for promoting economic development than either would alone. In this report, however, we focus attention on three major categories of infrastructure, one at a time.

Synopsis of Findings

The authors of the following three chapters have addressed some of the key issues raised here. Their answers vary in terms of details, but some common themes run throughout.

Does Infrastructure Contribute to Rural Economic Development?

Parker (in chapter 3) is the most positive of the authors, concluding that more heavily information-dependent industries can and will successfully locate in rural America if the appropriate telecommunications infrastructure investments are made. He also notes that improved telecommunications facilities can help a wide range of rural businesses achieve greater productivity. Rowley, Grigg, and Rossi (in chapter 4) find that sometimes, but not always, investment in water and wastewater infrastructure will contribute to rural economic development. They warn, however, of diminishing, even negative, returns on an excess of such investments. Forkenbrock, Pogue, Finnegan, and Foster (in chapter 2) distinguish among different types of transportation facilities. They are most positive about the economic development effects of investments in airports. On the other hand, they could find no strong evidence to support investments in highways, and they explicitly caution against making transportation investments that do not have economic development payoffs.

Do Infrastructure Shortages Exist in Rural Areas?

For many purposes, such shortages (in quantity or quality or both) do exist. Forkenbrock, Pogue, Finnegan, and Foster find enormous deficiencies in the state of rural roads and bridges. They do not, however, necessarily characterize these deficiencies as shortages; they suggest that lowered standards may be an appropriate action in some circumstances, enabling a reasonable level of service at a relatively low cost.

Rowley, Grigg, and Rossi offer considerable evidence of shortages in water and wastewater infrastructure. They note that many water systems have pipes much older than their expected life, and many wastewater systems are

operating above capacity. They cite national figures of the investments needed to bring facilities into compliance with various standards, including the Safe Drinking Water Act standards.

Parker found shortages in telecommunications: a large number (but a small proportion) of rural households have no telephones, and some communities are still on a party-line network. Examining the franchised monopoly system of telecommunications ownership, Parker reasons that, because externalities (that is, indirect benefits) are ignored, underinvestment in these facilities is likely.

*What Infrastructure Investment Is Needed in Rural Areas
To Stimulate Economic Development?*

Parker states very clearly that, for economic development purposes, investment in rural America should upgrade all rural telephones to the basic standard of single-party, touch tone service. Forkenbrock, Pogue, Finnegan, and Foster are skeptical about the need for investing in further transportation infrastructure. They describe the "millstone" of an "overbuilt" rural road network, and propose abandoning and lowering the standards of some of these roads rather than attempting to maintain them all at impractically high standards. Because of recent improvements in air and truck transportation for rural areas, they see no need for large investments there. Rowley, Grigg, and Rossi conclude that the case for infrastructure investment in water and wastewater facilities is simply not clear one way or the other.

*How Often Is Each Type of Investment Situation
(Necessary and Sufficient, Necessary but not Sufficient,
not Necessary) Found?*

The authors of all three chapters answer this question quite clearly: these physical infrastructure investments are often **necessary but not sufficient** to stimulate economic development. Also there are many cases in which physical infrastructure is **not necessary** for economic development. However, the authors do not identify any cases in which physical infrastructure is both **necessary and sufficient**.

*How Will the Economic Development Effects of
Infrastructure Investment Differ Between Metro
and Nonmetro Areas?*

Parker warns that telecommunications investment in rural areas, more than in metro areas, increases the ability to both import and export information. Improved telecommunications thus presents a rural area with the

opportunity to enhance the local employment situation, but it also brings the threat of some job losses as well. Parker also notes that deregulation in the telecommunications industry will probably widen the metro-nonmetro gap in both quality and cost of service.

Forkenbrock, Pogue, Finnegan, and Foster note that the metro-nonmetro population density differences will mean fewer economic development benefits from transportation investments in rural areas than in higher density metro areas. They find that transportation deregulation has, overall, not been more favorable to metro than rural areas; permissive Federal antitrust policies have, however, had such an effect.

*How Do the Probable Economic Development Effects
of Infrastructure Investment Differ by the
Existing State of the Infrastructure?*

Parker finds that the biggest economic development payoff for telecommunications investments are when a locality moves from no telephone service to some service. The second biggest payoff occurs when crossing the threshold to single-party touch tone telephone service.

Forkenbrock, Pogue, Finnegan, and Foster warn strongly that duplicating transportation services will probably not stimulate economic development. With respect to specific types of transportation facilities, they advise that obtaining rail freight service and scheduled airline service (at least within 50 miles) will probably have greater benefits than other investments.

Rowley, Grigg, and Rossi suggest that, as the quality and quantity of the existing facilities improve, diminishing returns are likely for water and wastewater investments.

*How Do the Probable Economic Development Effects
of Infrastructure Investment Differ by the Local
Industrial Composition?*

Forkenbrock, Pogue, Finnegan, and Foster find that investment in transportation facilities is more useful in stimulating development in "export" industries than in the retail sector or other "nonexport" industries. Rowley, Grigg, and Rossi see that water and wastewater infrastructure investments are more likely to lead to development in industries that are significant users of water or producers of wastewater than in other industries. In the same vein, Parker finds that telecommunications infrastructure investments are more likely to stimulate economic development in information services and information processing industries than in sectors involving the physical production of goods.

How Will Economic Development Effects of Infrastructure Investment Differ by Community Characteristics?

Rowley, Grigg, and Rossi note that differences in topography and population density will affect the costs, and thus the net effect, of water and wastewater investments in different communities. Parker finds that the appropriate telecommunications technology, and presumably the economic development effects, will vary from place to place. Forkenbrock, Pogue, Finnegan, and Foster also find that community differences will result in differences in the appropriate transportation links. They emphasize that the economic development payoffs from transportation investments will vary widely from place to place, depending upon the other strengths of the communities.

Summary

A wealth of research results is presented in the next three chapters. The authors leave the reader with a healthy degree of skepticism about the possibility of the direct stimulation of economic development across the spectrum of rural communities through just any infrastructure investments. On the other hand, the three agree that certain carefully selected infrastructure investments may often have good economic development payoffs, when these investments are made in places with the other prerequisites for development.

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Chapter 2

Transportation Investment To Promote Economic Development

**David J. Forkenbrock, Thomas F. Pogue,
David J. Finnegan, and Norman S. J. Foster***

Efficient transportation is essential to economic development in rural areas. But, what is adequate transportation for one area may be too much or too little for another. Deregulation of the various transportation modes has generally benefitted rural America, but not uniformly. Limited budgets will require Federal, State, and local governments to carefully evaluate plans for improving rural transportation.

Ample transportation facilities are vital to rural areas' development potential because they enable access to resources, goods, and markets. Good access alone, however, will not ensure economic development. Other necessary factors include available and competitively priced land, labor, capital, and natural resources; attractive tax rates; an acceptable life quality; and the presence of other types of infrastructure (24).¹

The general issue of transportation investments as an economic development lever has many elements of complexity--different modes are involved (such as highways and roads, public transportation, rail, water, and aviation); both people and goods are transported; and service may be provided by the public sector, private businesses, or a combination of the two. The different levels of government involved employ a variety of funding mechanisms and often are pursuing rather diverse objectives. Further complexity stems from the fact that the major economic forces acting upon rural areas--forces over which local areas have no control--are changing significantly. If transportation investments are to contribute to economic development, they must be responsive to emerging economic circumstances.

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¹ Italicized numbers in parentheses identify literature cited in the References at the end of this chapter.

Changing Rural Transportation Needs

As the rural population in most of the United States is relying less on agriculture, its transportation requirements are changing. Personal mobility is becoming more important as increasing numbers of rural residents commute to jobs, but not all of these jobs are in metro areas. An increasingly important factor stimulating travel demand in rural areas is "outsourcing," the growing practice by some industries of purchasing components from the most cost-effective supplier. With lower wage rates and good work habits, smaller communities are attracting smaller plants that supply components to major manufacturers. A result is increased commutation on certain rural road systems. Traffic volumes on these road segments often warrant better facilities than now exist.

As support facilities (such as hospitals, retail outlets, and schools) in smaller rural communities decline, increased trips to larger population centers are taken. Thus, the overall vehicle miles of travel on most rural road systems is declining, but the lengths and concentrations of trips are increasing. A shrinking rural population is traveling farther on limited portions of the rural road network, principally those routes that lead to job sites.

Overbuilt rural road systems have become a millstone around the neck of many rural States. For many States, both the maintenance standards and density of some rural roads are much greater than required for the current level of traffic flow. In some regions, the increased seasonal use of fewer, heavier vehicles to transport timber or agricultural commodities increases maintenance costs. Even though inadequate maintenance (by engineering standards) is all that is affordable on lower volume rural roads, the cross-subsidy to users of these roads by other highway users is substantial. In Iowa, for example, users of the primary road system are paying \$54 million more in State dollars alone than is spent on this system, and urban system users are overpaying by \$7 million. That State is spending \$61 million per year more on secondary roads than is being collected through users fees from those traveling on these roads (2).

Service cutbacks in other transportation modes have become commonplace in rural areas. Railroads have abandoned large numbers of less productive branch lines where traffic has fallen to uneconomic levels. In some cases, these abandonments have hastened the economic decline of rural communities; in others, they merely reflect the decline that has already happened. One response has been the emergence of short-line or regional railroads operated by local governments and other organizations. A recent survey of shippers found that they are generally satisfied with both the service and rates that short-line and regional railroads are offering (31). The long-term success of these short-line railroad operations will depend on

maintaining sufficient traffic levels, generating enough resources to reinvest in tracks, and obtaining flexibility in labor rules.

Rail carriage is nationally being eclipsed by trucking service. Between 1970 and 1985, rail's share of all freight expenditures fell from 14.5 percent to 10.9 percent. Intercity truck carriers' share rose from 40.8 percent to 48.1 percent (23). Rural communities' economic health increasingly depends on the level and relative cost of truck service because trucking is the only mode available for shipping raw materials, natural resources, and manufactured products in many areas.

Just as the cost and availability of transportation for shipping goods figures strongly in rural areas' competitive postures, so also do personal transportation services. The most important passenger-carrying mode, other than automobiles, is airline service. The ability to fly quickly and cheaply from a particular location to other points of economic activity makes the location more attractive by lowering the cost of doing business and providing access to otherwise inaccessible spots. Good air service also promotes economic development by enhancing the quality of life as it makes recreational travel easier.

Several major Federal programs provide funds for rural transportation services nationally. In each case "rural" is defined as counties with urban populations of less than 20,000 (25).

- **Airport Improvement Program**--This program provided about \$1 billion in fiscal year 1987 for airport planning, construction, and rehabilitation. In fiscal year 1985, 9 percent of its funds went to rural areas.
- **Highway Planning and Construction Program**--In fiscal year 1987, this program provided about \$12.9 billion to help fund Interstate highways and primary and secondary roads. About \$460 million (3.6 percent) was allocated to secondary roads; this figure approximates the rural portion of the program. Other aspects of the program also directly affect rural areas.
- **Public Transportation Section 18 Program**--This program provides grants to improve public transportation in rural areas and communities with less than 50,000 population. In fiscal year 1987, about \$82 million was distributed to the States; they, in turn, allocated funds to localities using their own criteria.

- **Essential Air Services Program**--The objective of this program is to maintain service to smaller communities following airline deregulation. It provided payments of about \$27 million in fiscal year 1987. In fiscal year 1985, 11 percent of these payments went to rural areas.
- **Local Rail Service Assistance Program**--In fiscal year 1987, this program provided \$25 million in grants to States to help maintain rail lines and services in the face of abandonments and reduced service by railroad companies. Most of these projects were in rural areas or directly benefited them.

Deregulation and Related Changes in Rural Transportation

Congress and recent Federal administrations have significantly deregulated various transportation modes over the past decade. Opponents feared that deregulation would limit the availability and escalate costs of both passenger and freight service in small communities and rural areas. Many opponents also believed that deregulation would increase the trend toward mergers and takeovers and leave the individual industries with an oligopolistic market structure. Although these fears have become a reality in some cases, the reasons for these changes do not always lie with deregulation but rather with the changes in the transportation market itself and especially with permissive antitrust policies at the Federal level.

Airline Deregulation

The Airline Deregulation Act of 1978 eliminated the Civil Aeronautics Board's authority over the routes airlines could serve and its control over air fares. Since December 31, 1981, individual airlines have been largely free to deliver or not deliver service to any location and to charge fares as they see fit. Carriers can suspend service to a given location, but the Act introduced the Essential Air Service program that guaranteed that small communities having regulated service before deregulation would continue to be served for at least 10 years. Carriers can still terminate or decrease service, but they must file notice with the Department of Transportation and with the appropriate State and community agencies involved. If alternative carriers cannot be found, the airline can be subsidized to the extent of actual financial loss, and some subsidies are now available to provide an incentive for carriers to provide service on nonprofitable routes.

Deregulation has generally improved air service to small communities (7). Before deregulation, many small markets were served by relatively large jet

aircraft that made multistop journeys to larger cities (1). With deregulation, commuter airlines have substituted smaller propeller-driven aircraft for jet service and increased departure frequencies from small airports. Moreover, by concentrating on nonstop or single-stop service to nearby hub airports, the airlines have decreased travel time in many instances. The result has been significant growth in the total market to many small communities. The total number of passengers carried by regional and commuter airlines (those flying planes with fewer than 60 seats) increased from 12.9 million in 1980 to an estimated 27.2 million in 1987, an increase of 111 percent (29). Although some of this increase simply reflects situations where major carriers dropped service and commuters replaced them, the overall commuter market has still shown impressive growth. The number of domestic passengers carried by the large trunk airlines increased by only 49 percent over the same period.

Although the overall effect of deregulation has been positive for small communities, there have been winners and losers. About 140 communities have lost all air service (26). However, almost all of this lost service was unregulated before deregulation, so the airlines serving those communities could have stopped service at any time (16). Only those places served by regulated carriers were guaranteed continued service by Congress. Thus, the public policy issue of how to respond to a complete loss of scheduled air service is one that would have been faced today even if deregulation had not taken place.

A number of communities now have fewer departures per day than before deregulation. Deregulation has been largely responsible for this change as airlines have been free to reassign their equipment across their entire route network. Moreover, many small communities believe that the replacement of jet service by propeller-driven aircraft has reduced the quality of air service significantly, even if the number of daily flights has increased. These reductions in service to some communities have been matched by increased frequencies from other small communities; aircraft departures from small communities increased overall by 9 percent from 1978 to 1984 (15).

The effect of deregulation on air fares has varied greatly. Fares are generally lower in real terms than before deregulation, but the benefits have varied greatly. At one extreme, business travelers who wish to retain flexibility in their travel plans pay almost the same real fare as before deregulation. At the other extreme, leisure travelers who can stay over weekends and book in advance have benefited greatly, especially when traveling between major cities. By 1983, over 60 percent of all passengers received discounts of up to 40 percent or more from full coach fares (15).

Travelers from small communities have benefited less from lower fares available under deregulation (17). A smaller proportion of travelers on commuter airlines than on larger carriers used discount fares in the early years of deregulation. On some routes to small communities, fares have increased in real terms, although this may reflect a higher proportion of business travelers in those markets. Thus, the effect of these changes in air service to small communities on their potential for economic development is mixed. For those communities that have retained or increased service, regular flights to a nearby hub airport provide a level of service that is probably no less attractive than existed before deregulation. The hub-and-spoke service configuration that has emerged under airline deregulation has made flying to and from smaller communities relatively less convenient than is the case with larger cities.

One issue that may become increasingly important in the future is whether commuter airlines can maintain access to large airports, especially during peak hours. Because of the shortage of capacity at some major airports, authorities may seek to reduce the number of commuter flights during these periods, and small communities may lose some service. Massport, which operates Boston's Logan Airport, has in the last few years proposed a system that would increase landing fees for small aircraft at all times, but it has been rejected by the U.S. Department of Transportation. Similar schemes will probably be advanced in the future, however.

For those communities that have lost scheduled air service completely, their potential for economic development may be seriously threatened. Few companies will consider locating in a community that has no regular air link to a nearby hub airport. However, some of the communities losing scheduled service are close to nearby large airports; they lost service in part because some people prefer to drive 1-2 hours instead of paying for a short flight. In those cases, the potential for economic development has probably not been affected to any serious degree. Of 106 airports which lost scheduled service from 1978 to 1983, nearly 60 percent were within 50 miles of another airport, and another 33 percent were less than 100 miles from another airport (19).

A few communities may have faced difficulties because scheduled air service has been uncertain, rather than withdrawn completely. As carriers withdraw and add routes, some cities may have experienced periods without service. The uncertainty generated cannot help efforts to attract investment to the area. How widespread this problem is remains unclear.

Bus Deregulation

The Bus Regulatory Reform Act of 1982 mainly allowed carriers free access to enter or exit markets of their choosing. Unlike the Air Deregulation Act, it did not provide for continued service to any less-than-profitable routes. Thus, service to many small and rural communities has been dramatically cut. However, deregulation has merely hastened an already established pattern toward service reduction by major intercity bus lines (7). Demand for bus transportation has dropped precipitously, especially since the end of World War II. Travelers have been drawn away from buses as more people have purchased automobiles and as air fares have become relatively cheaper.

Proponents of deregulation believed that new smaller bus lines would fill the void left when major carriers streamlined their services by eliminating costly, low-revenue routes. They anticipated that easy entry would stimulate the creation of these new bus lines, creating competitive pressures for existing companies. These changes have not materialized. When service to abandoned routes has been restored, it generally has been provided by existing carriers. However, even when these routes are serviced they are often little used. Low ridership tends to confirm many bus companies' belief that the demand in many rural areas and smaller communities is insufficient to warrant service.

Deregulation has allowed carriers to exit from a number of unprofitable routes. A study of 12 States found that abandonment did not begin with deregulation, but the rate of abandonment increased sharply immediately after deregulation (19). Most of the abandoned communities were small, but those with larger proportions of poor, older residents tended to lose service less often than was true generally. Bus companies appear to have been concentrating on their most likely customers, the poor, elderly, and those without automobiles.

The loss of bus service may have substantially reduced the mobility of many people in rural areas who are old, poor, and without cars. Without bus service, these people have virtually no alternative means of making intercity trips. However, the effect of losing bus service on a community's potential for economic development will rarely be very important. Few business trips are made by bus, and trucks or railroads are far more important for moving goods. Thus, the cost of bus abandonment is much more the social loss of mobility for certain groups than any threat to future economic development.

Two encouraging trends have emerged recently. Some charter bus lines have initiated service on marginally profitable routes to bolster total revenues but in a way that does not alienate their existing profitable charter business. There have been efforts to establish feeder networks, such as Greyhound's

Rural Connections program, that enable travelers in small communities to establish a bus connection in larger cities. Whether these types of service can be provided in a cost-effective manner over the long term is still unclear.

Motor Carrier Deregulation

The Motor Carrier Act of 1980 was meant to create a more competitive environment for the U.S. trucking industry. Barriers to entry and exit were almost completely removed, rate-making policies became less restrictive, and motor carriers were allowed to transport a wider range of products. Deregulation has greatly eased route restrictions which, in turn, have caused shipping rates to fall dramatically.

Easier entry into the industry has greatly increased the number of trucking firms, especially small firms serving localized markets. The number of regulated motor carriers increased from 18,000 in 1980 to over 30,000 in 1984 (32). The advent of trucking brokerage firms has enabled small carriers to enjoy coordination and networking benefits previously provided only by and for large carriers, who conducted this function internally. Thus, smaller firms can locate and target potential markets for their services. Small communities and rural areas, many of which have suffered from railroad abandonment, have benefited from an increased number of available carriers providing service at a lower price than before deregulation. Most carriers initially competed on price, but the competitive emphasis has switched more to service and performance.

The increased number of firms, coupled with better service, has brought major benefits to users. This improvement is especially important for rural areas that will no longer be locked into permanent, long-term relationships with a few, select carriers. The available carriers also compete on the basis of both price and service quality, often resulting in a better overall value for users. If one firm does not supply a needed type or level of service, at a reasonable price, the shipper can look elsewhere rather than being bound to a higher price or less valuable service. Thus, transportation costs as a percentage of overall costs typically are lower now than before deregulation.

Railroad Deregulation

Responding to pleas from the railroad industry concerning its financial performance and physical condition, Congress has enacted major regulatory reforms in that industry. The Railroad Revitalization and Regulatory Reform Act of 1976 promoted a more competitive market environment and cost-based rate structures. The Staggers Rail Act of 1980 gave railroads the ability to set rates on the basis of competition, demand, and operating costs.

Costs to shippers for rail delivery have declined since deregulation. These declines partly reflect the ability of rail firms to carry more tonnage per rail car and to increase the number of fully loaded cars per train. The abandonment of certain unprofitable rail lines has also helped to reduce costs. Railroads no longer must subsidize expensive short-haul lines with revenues from more lucrative long-haul operations. These changes have improved profits for railroads. However, railroads have discontinued service to many rural areas, including small communities that have traditionally depended on such service.

In the 20 years before the Staggers Act of 1980, an average of 1,574 miles of track was abandoned each year by major railroads. After the Staggers Act, abandonments increased to 3,766 miles per year between 1980 and 1985. However, new short-line railroads have taken up an increasing number of miles of track formerly operated by major railroads and added on net 1,961 miles in 1985, 3,151 miles in 1986, and 6,557 in 1987. This trend has reduced the miles abandoned by major railroads to an annual average of 2,177 miles during 1986-88 (27).

We cannot be precise about the overall effect of abandonments on transportation rates and transportation service for small communities. In those areas where short-line railroads replaced major railroads, shippers have expressed satisfaction with both the service offered and rates charged by the new railroads (31). Trucking deregulation appears to have improved service to small communities as a group, according to a study of small towns in eight different States (20). But railroads are still very important to rural America, and communities that have lost all rail service have in many cases been badly weakened (27).

Deregulation has not always increased competition. Mergers of large railroad firms following passage of the Staggers Act have increased concentration in the railroad industry, especially among the top four carriers. These firms held 35 percent of total railroad revenues in 1971, compared with 44 percent in 1984. But, the trend of railroad firms toward concentration, with fewer miles of railroad in service, is not at all new and began long before regulatory reform. The shift in the U.S. economy away from production and towards service activities, an increased importance of global markets, and intensified truck competition have all greatly contributed to changes in the railroad market. Deregulation is not the single cause of these changes, but it has hastened the restructuring of the railroad industry, particularly in terms of line abandonments and rate-setting.

Overall Effects

The national movement toward deregulation has had a mixed effect on the economic development potential of rural communities. Some small communities have gained service or experienced lower transportation costs after deregulation. Others have lost one or more types of service completely or faced significantly higher costs for transportation.

Airline deregulation has probably increased the overall level of service to smaller communities, although many communities have lost all or most service. For those losing service, the only means of access to the rest of the country may involve a long auto journey to the nearest commercial airport. Communities losing air service have become less competitive for economic development as the cost of doing business has increased.

The level of service to small communities by intercity bus firms and railroad carriers has fallen in recent years. However, deregulation is not so much the reason as is the very nature of the two industries themselves. As the characteristics of the individual markets have changed, so too have the quality and quantity of service provided. A major concern with losing bus service is that it is often the only form of transportation available, particularly for elderly and low-income residents. However, a loss of bus service will usually have little effect on a community's potential for economic development because very few business trips are made by bus, and buses are relatively unimportant for freight movement. The loss of rail service, however, can affect economic development potential by increasing the average total cost of production in a particular area if the alternative to rail shipment is a more costly form of transportation.

Deregulation in the motor carrier industry has been somewhat more beneficial for rural areas and small communities. Reduced barriers to entry and exit have allowed larger carriers the option of abandoning marginally profitable routes in favor of more heavily utilized routes. Increased competition, because of large-scale entry into the market by smaller firms with lower costs, has stimulated an overall reduction in the price of motor carrier service. Lower prices and improved product quality have made motor carrier service a better value for rural residents. This outcome may not promote economic development, but it may be the difference in preserving existing operations.

Investment and Economic Development

Many accounts have been published about the condition of rural transportation facilities in the United States (18, 33). Rarely do those accounts reach positive conclusions regarding the ability of the Nation's

transportation systems to support future productivity increases and economic development. Some argue that transportation investments should be responsive to needs assessments; by this definition the construction program required for roads and bridges (and other rural infrastructure) is enormous:

- Of the Nation's 468,095 rural highway bridges over 20 feet long, 216,791 (46 percent) are rated in the National Bridge Inventory as having structural or functional inadequacies (28).
- Some of the Nation's 136,000 railroad bridges, especially those found on short-line railroads, may also pose problems.
- Of the 33,111 miles of rural interstate highways, 3,853 (11.6 percent) have pavement in poor condition. For other rural highways, 6.0 percent of primary arterials, and 7.1 percent of minor arterials, are also in poor condition (30).

How many of these deficient bridges and roads should be reconstructed and how many should either be closed or allowed to operate at a lower service level (3)? Under what conditions should facilities be upgraded or new ones built? Transportation facilities are important to economic development only if the demand for their use is sufficient; otherwise, these facilities can represent a lingering cost burden that pays no real dividends. In this discussion, we focus on rural highways because they represent, by far, the largest type of transportation investment. The fundamental concepts at work also apply to other modes.

Efficiency in Highway Investment

Economic development may be broadly defined as increasing the real income that individuals derive from economic activity within an area. Therefore, when economic growth is the policy objective, the benefits and costs of an infrastructure investment project, highway or otherwise, are appropriately defined as the project-induced changes in the real income that individuals derive from increased economic activity. Increases in real income are benefits, and decreases are costs. If a project's benefits exceed its costs, it increases real incomes in the aggregate and is termed "efficient." Some people may enjoy an increase in real income because of the project, but others may experience a decrease. If the project is efficient, the gains of the gainers offset the losses of the losers. If a project is inefficient, however, those who suffer from the project will lose more than those who gain will benefit, and the overall effect is a loss in total income.

Highway Benefits and Costs

Highways are essentially tools for transporting goods and people from one place to another, and highway investments generate benefits only to the extent that they lower transportation costs. In other terms, highways are intermediate goods used in the production of final goods. Lower costs may be realized in numerous ways, including decreased travel time, increased safety, decreased fuel and other operating costs, and reduced noise or air pollution. All of the benefits of a road, and therefore the justification for building it, however, flow from using it for transportation. Road investments should be made only when they lower transportation costs enough to warrant the investment costs (including the present value of future maintenance and operation costs). Transportation cost savings include safety and environmental benefits, as well as reduced travel time and vehicle operating costs.

Highway benefits may not only accrue to persons and businesses whose vehicles use the highway. Lower transportation costs may be passed on to consumers as lower prices for consumer goods, to workers as higher wages, or to owners of businesses as higher net income. Persons may thus benefit from a highway without traveling on it, when travel on the highway increases the income that they derive from the resources they own, or when such travel increases the purchasing power of that income (by reducing the prices paid for commodities). All highway benefits derive from lower transportation costs, but they can also be represented as increases in the real incomes of individuals in their roles as consumers and producers, regardless of how the benefits are initially realized and regardless of the extent to which they are passed on to consumers and resource owners who do not directly use the highway.² Furthermore, increases in real income may in some cases be capitalized into asset values. For example, the value of land at a particular location may increase when road transportation to the location is improved. Thus, when estimating highway benefits, one must not double count by including both the transportation cost savings and the increases in real income and asset values that they induce.

Decisionmakers should be careful to investigate the net effect of highway projects, looking at both the benefits generated along the corridor in question and any costs or loss of benefits elsewhere. Building or improving a particular stretch of road may, in fact, reduce the benefits derived from existing highways if the improved road attracts users from alternate routes.

² Real income includes the value of environmental amenities, safety, and other "goods" that are not ordinarily traded in the market place. Real income is, therefore, not merely the purchasing power of monetary income generated by market transactions.

For example, upgrading an existing highway to four lanes may lead some businesses to locate along the upgraded highway. But, the project does not necessarily increase overall business activity if the businesses could have located at an equivalent site on an existing four-lane road. Instead, the project in this case simply diverts activity from already available sites to new sites. The project may increase income and property values for owners of property along the upgraded road, but at the expense of owners of property along existing roads. Furthermore, the project generates a net loss for the region as a whole unless the benefits to current users exceed the cost of the upgrading. Thus, State and local officials should be careful to judge the net benefits of a given project, and Federal officials should be wary of simply diverting economic activity from one State to another when deciding if a highway project is justified (8).

An important policy issue is what portion of low volume rural roads should be financed through traditional user fees (such as motor fuel taxes and registration fees). Relying on these mechanisms will require continued, and perhaps increasing, cross subsidies from users of other, more heavily used roads. These subsidies raise the costs of the overall highway system (reducing the net return on labor and capital investments) or diminish the available funds for maintaining more heavily used roads (14).

One might argue that special, nonuser taxes are a reasonable approach to financing very low volume rural roads. The beneficiaries of these roads are a small number of travelers who use them for access to their properties (the roads, in effect, serve as driveways). Assigning a special property or lineage tax to landowners along the road would serve to reduce the cross-subsidy to users of these particularly low-volume roads. Other strategies would be to lower the maintenance standards of low-volume roads to better conform to current patterns of usage or transfer ownership of the roads to the adjacent property owner or owners.

Many serious barriers exist to each of these alternative courses of action. In less prosperous rural areas, saddling landowners with an additional tax would be sufficiently burdensome to them to make the tax politically unacceptable. Lowering maintenance standards on roads increases the risk of claims for injuries or property damage. Transferring roads that have bridges in need of rehabilitation could be catastrophic to the landowner because of the sizable capital cost that often is involved in repairing these bridges.

Many more dollars will be required to maintain transportation facilities at current standards than will be available even under the most optimistic circumstances. Both investment and disinvestment have become important types of decisions in rural America and will continue to be. With extensive

needs and limited resources, justifying significant expenditures in the hope that they will make an area attractive for economic development will be difficult. Careful investment analyses based on demand levels are the surest hope for efficient transportation.

The ideal situation for investing in transportation facilities to help foster economic development is when all other necessary ingredients (labor, land, other infrastructure, natural resources, and lifestyle amenities) are present, and transportation is indeed the limiting factor (10). If those factors are present, and if an otherwise equally suitable site for industrial development without the transportation limitation does not already exist, the investment has a very good chance of contributing to a stronger area economy. Otherwise, the question is whether other key ingredients can be attracted by virtue of good access. Assessing an area's ability to attract these other ingredients is a difficult but essential task that must be carried out before making a transportation investment.

Empirical Evidence

The conceptual principles guiding transportation investments are reasonably clear when the objective is economic development, but there are few well-documented studies of actual projects (9). The fundamental difficulties stem from the inability to answer these questions:

- Would the development have occurred without the transportation investment, even if in a different location?
- Was the development really a shift in activity from prior locations to new sites served by the highway investment?
- Would the investment have been made by the affected enterprises anyway? If so, the societal resources used to build the transportation facility did not add to development but constituted a transfer to the businesses.

Our analysis of State-level highway programs intended to help foster economic development suggests that these "unknowables" seriously restrict rigorous impact assessments. Improved accessibility may have contributed to, but not necessarily created, job growth such that the wages paid are higher than the average for the area. Whether the projects were actually efficient is hard to assess.

A study by Stephanedes and Eagle suggests that the effects of highway investments probably vary between urban and rural areas (21). In that study, the authors correlated the level of expenditures on highway construction at

the county level in Minnesota with job growth over a period of 10 years. They found that expenditure levels in urban areas were correlated with increases in employment in manufacturing and retail trade. In rural areas, however, highway expenditures were associated with short-term minor gains in employment (construction induced) and losses in the longer run. Hansen also found that proximity to a metro area was more important in explaining relative nonmetro county population growth rates than was the presence of major highways (11).

Isserman and his colleagues investigated the effect of highways on smaller communities and rural areas that highways traverse (13). The authors examined growth rates of income, by employment sector, during 1969-84 for 231 small rural communities, some with highway access, some without. Rural counties through which highways passed did not grow significantly faster than those without highway access. They also found exactly the same growth rate for rural communities on two-lane roads as those at the intersection of two Interstate highways. A study by Briggs of the effects of highways on economic development examined net migration and employment changes for nonmetro counties. He found that the effect of the presence of a highway was weak to nonexistent in remote, less developed rural areas, after controlling for other factors (4, 5).

All of these studies have approached the issue of highway effects by constructing control groups of areas unaffected by highway investment and comparing their economic condition with areas that had major highway investments. A limitation of studies that attempt to associate highway investments with economic growth is that one cannot deduce whether a growing economy led to road construction or the reverse. Most empirical evidence suggests that highway investments in rural areas are far from certain to bring about significant increases in economic activity in these areas. Straszheim summarized the situation well: "[T]he weight of current evidence concerning the usefulness of using transportation investment...as a regional development tool would appear to be on the side of the skeptics" (22).

The difficulty in empirically assessing the effects of rural highway investments is determining whether growth that occurred following construction of a new or improved facility was the result of that construction or some other factor. Entrepreneurial activity, local amenities, and other relatively intangible factors often determine which smaller communities grow and which do not. Empirical analyses of road investments and local economic growth have not successfully taken these factors into account. Huddleston and Pangotra point out that the positive stimulus of better roads will result only if the resources (human or otherwise) that are utilized as a result of the roads were previously not employed to their full potential (12).

Summary Assessment

The following observations stem from our previous discussion:

- Assessing the ultimate economic development effects of a particular transportation investment in a rural area is difficult.
- Investments duplicating facilities at available sites elsewhere are unlikely to result in aggregate growth. These investments may, in fact, hamper economic development.
- When the attraction of a specific business entails a transportation investment, several key questions should be considered in the context of an overall assessment of the probable costs and benefits.
 - Would the business come anyway, perhaps in the same location, perhaps in another?
 - Is the business the type that adds new sources of income to the area, or does it serve existing activities (in which case incentives are probably not needed)?
 - Might the business increase the overall wage level of the area?
 - Is it an activity that is far less fixed in location than the transportation infrastructure being supplied?
 - And above all, will the facility serve enough traffic to make its construction an efficient use of society's resources?
- The real potential for transportation investments in rural areas is to help attract manufacturing, tourism, and other export activities. Subcontracting trends allow rural residents to gain employment, thus spurring economic development. Gains in retail activity, however, do not appear likely because of the pricing consequences of the much greater volumes traded in larger communities.
- Difficult decisions lie ahead as to which existing facilities should be upgraded, maintained, or closed. The nature of rural transportation needs is changing; the best system for yesterday will probably not be best in the future. Investments not made

will be as crucial as those that are if the objective is to create a setting conducive to economic development.

Policy Options

In the coming years, important transportation decisions will be made by Federal, State, and local governments. Federal decisions will probably pertain to major facilities (such as four-lane highways connecting cities not directly linked by the Interstate system) and maintenance considerations. State investment decisions will probably be the most complex and will include difficult choices as to how resources are allocated. Local governments' choices may center around how best to promote development with very limited resources. The following policy choices represent different priorities for fostering economic development through transportation in rural areas.

Focus on Connections to Out-of-State Markets

State and local economies depend on exporting products to outside markets to bring new income into the area. Making the most of these connections has been a goal of Federal programs. Investing in highways and, possibly, railroads, airports, and other facilities under certain conditions can reduce the cost of doing business in a particular area, thus improving its competitive position. Projects that pursue this objective might include the following:

- Upgrading roads linking smaller communities to Interstate and other major highways.
- Improving air and rail connections between population centers in neighboring States.
- Designating multistate commercial highway networks to help the movement of goods.

In each case, however, careful forecasts of use and a weighing of costs and benefits should be the basis for investment decisions, not a wistful hope that development will follow speculative construction of expensive facilities.

Provide a Specified Level of Access to Small Communities

Federal, State, or local governments could decide that, when transportation services to small communities fall below some "essential" level, they would finance one or more modes of transportation to regain the desired service

level. This option may be especially important for air, bus, and rail service and may even be used for truck service in some cases. For example, the Federal Government began supporting airline service to about 100 small communities after airline deregulation through the Essential Air Services program. Support of this type would improve access to the communities involved and would thus have the potential to increase the chances of economic development. However, many communities lack other factors needed for economic development; in such cases, improved transportation facilities may produce little in terms of actual development. The conceptual and empirical work on the subject offers the general conclusion that good transportation links can only support, not create, economic development.

The cost of such support on a large scale, either within a State or in several States, is unknown. The Essential Air Services program is relatively small-scale in terms of the Federal Government (about \$25 million annually during its first 10 years), but the cost for each of the approximately 100 communities served is quite high, especially because relatively few passengers are involved. If a State wished to guarantee a significant amount of essential service, the level of support required to serve a large number of small communities with one or more modes would probably be fairly substantial.

Match Facilities with Travel

A policy direction that would maximize the overall development potential for a State is to match the standard at which a given road is maintained with its economic value. This policy would stress economic efficiency in that facilities generating the greatest user benefits (that is, those with the heaviest traffic volumes) would be maintained at the highest levels. Thus, rural areas with the most severe accessibility problems would not necessarily be well served. This policy orientation would, in fact, tend to strengthen the competitive advantage of areas with strong and growing economies.

Encourage Research and Development

As the travel needs of rural America change, requirements of its transportation facilities also change. For example, many bridges on secondary roads in rural areas are inadequate, but traffic volumes on them have declined to low levels. Research could identify lower cost approaches to rebuilding low-volume bridges and lowering their weight-bearing capacities. Timber bridges may offer one less expensive way to replace deteriorating rural bridges. About 10 percent of all U.S. bridges are timber, and most serve lightly travelled rural routes with fewer than 100 vehicles per day (6). Grain trucks and other heavy vehicles could be rerouted to avoid these bridges.

Research into advanced truck chassis design also holds the promise to significantly reduce axle loadings and, thus, damage to road surfaces. Because rural areas depend on motor carrier service more heavily than in the past, especially in areas where railroads have been abandoned, the ability to transport relatively large loads without excessive roadway damage would be especially beneficial. Further research on more efficient goods movement methods could lead to lower costs of doing business in rural areas and, hence, increased economic development potential.

Conclusions

Rural areas and small communities in America are changing significantly, and transportation policy has also changed. If current highway use patterns continue, fewer miles of rural roads will be needed, but safe, efficient roads will be even more vital if these areas are to effectively compete for economic activity. Excessive expenditures on speculative facilities or those that will probably not carry much traffic can actually weaken economic development potential because user charges and taxes will be comparatively high.

Major regulatory changes have taken place in several transportation modes important to rural areas. The effects of these policy changes have been mixed. Motor carrier deregulation, for example, has resulted in net gains to many rural areas. Under deregulation, however, demand is the key variable in the level, distribution, and cost of transportation services. Because rural areas normally ship and receive smaller quantities of most goods, transportation costs will probably not contribute much to rural areas' competitive strength.

When thinking of transportation and its relationship to economic development in rural areas, one must always remember that transportation quality is always relative. All areas of the country can never be equally accessible. For example, even if every community in America had a four-lane highway leaving in each direction, some places would still have locational advantages by virtue of being closer to large centers of economic activity. Moreover, if all roads were four-lane, six-lane roads might become the standard by which "good" access is measured.

Appropriate transportation links from each community to the rest of the Nation is an attainable goal, however. What "appropriate" means will vary depending on the population, economic characteristics of the area, and its position in relation to large-scale transportation networks. Our goal should be that the level of transportation services to small rural communities not constrain development that otherwise would occur. When the combination of entrepreneurial effort and an effective matching of local resources (labor,

capital, land, and natural endowments) with opportunities creates a clear potential for economic development, transportation investments should be considered.

Various public policy options exist for improving transportation in small communities and rural areas. Among the possible options are focusing on connections to regional and out-of-state markets, providing a specified level of access to and from small communities, matching facilities with travel demand, and encouraging research and development. Prudent policy decisions regarding transportation in rural areas will involve devoting limited resources to improvements capable of fostering economic development and forgoing those that are not.

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Chapter 3

Communications Investment To Promote Economic Development

Edwin B. Parker*

In the absence of the other development activities, investing in telecommunications services for rural areas will not ensure economic development in those areas. But, with some exceptions, the availability of basic telephone services is necessary for the success of any business or economic development activity. Some rural areas in the United States are still without telephone services. Many rural areas are served by telephone systems that do not offer the basic services needed by businesses: single-party touch tone telephone service that provides quality sufficient for facsimile (fax) or data transmission.

Introduction

Rural America is following urban America into an "information age" in which a wide variety of information services is an increasingly critical factor of production for all businesses. Two results of the increase in information services in the national economy are productivity gains in traditional businesses stemming from their enhanced use of information processing and a growth of information-based services businesses. Rural America must follow or be left out of the expansion of information services markets and left uncompetitive in other national and global markets. Information services markets, particularly producer and export services such as telemarketing and financial services sold to other businesses and regions, are a most promising growth area. With the availability of appropriate telecommunications infrastructure, those services can be located in rural as well as urban areas without paying the typical rural penalty of higher transportation costs to market.

Appropriate investment in telecommunications infrastructure is one critical element of rural economic development strategy. Telecommunications, like

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transportation, electrification, and other physical infrastructure, cannot "cause" economic development to happen, however. Economic development, if any, will depend on how the infrastructure is used to expand or create markets or to improve the productivity of suppliers to existing markets.

Appropriate physical infrastructure, including telecommunications, should be viewed as the third of three elements, all of which are necessary for successful economic development. The first is investment in human capital, primarily through education and health services. The second is to make appropriate changes in the "social infrastructure" or institutional arrangements that create and support the incentives and the means for people to compete more successfully in national and global markets. Investment in the physical infrastructure of telecommunications is a necessary, but not sufficient, condition for rural economic development.

Communications Infrastructure Defined

Communications investment will be required to build the rural "electronic highways" that are the essential infrastructure for a healthy information services economy. The communications infrastructure (usually referred to as telecommunications) can be defined as the facilities necessary for networks that switch and transport voice, data, or video information among users. (This definition excludes the information processing technology that users can purchase independently to process information in stand-alone fashion or to connect to the network for transmission or reception, even though network standards are necessary to permit interconnection. Computers, television receivers, telephone instruments, facsimile (fax) machines, answering machines, and other user-premises equipment that is subject to individual purchase decisions are, by definition, outside the shared common network infrastructure needed to interconnect those users. Telephone exchanges necessary to establish (switch) connections between caller and called party are included, as are telephone company lines and other transmission capacity. This infrastructure definition excludes radio and television broadcasting because no switching is involved in such broadcast mass media.

This definition of physical telecommunications infrastructure also excludes the related areas of user skills and user information services, which could be included as a component of human capital investment. The larger issue of information technology standards is a major national policy issue affecting both rural and urban parts of the country. The evolution of generally accepted open standards (compared with company-specific proprietary standards) for both computer and communications technology will substantially affect the national economy. The outcome of the current Federal Communications Commission proceeding concerning Open Network

Architecture (ONA) standards, for example, could have substantial long-term effects on rural and urban parts of the national economy.

The communications network infrastructure of primary concern is the telephone network, although cable television could also fit the definition when switching capability is provided. Video services are of lesser importance to economic development than voice and data services today, but they may become more so in the future as more business and educational video applications are developed. In rural areas, telephone and cable television networks may merge into a single network of optical fiber. Rural infrastructure planning should take into account voice, data, and video applications, particularly in rural areas that may not be able to afford duplicate infrastructures, because both telephone and cable television networks may shift to fiber optic transmission technology, which can handle readily all three types of applications.

Other technologies, including coaxial cable and microwave, can also transport voice, data, and video, but optical fiber is becoming the medium of choice in most new high-capacity applications. For most rural low-capacity voice and data applications, digital radio technology may be a preferred low-cost technology in locations where radio is less expensive than copper wire.

Changing Technology

Communication technologies are rapidly changing in both technical capability and cost. Modern telephone switches are virtually indistinguishable from computers, except in their application. Thus, many new voice and data services may be available through the telephone network for those users connected to a modern digital switch. New services will not be available to those users served by older analog switches. At current rates of switch replacement, upgrading all rural telephone carrier switches to digital will take until 2016 (9).¹ In 1987, 68 percent of rural telephone exchanges were still analog.

Fiber optic technology is particularly cost-effective on high traffic volume interurban trunk routes, but still difficult to justify on the "subscriber loop" connections between users and the local exchange switch unless the fiber optics can also be used for video services, such as cable television. Communication satellites are particularly cost effective for distribution of

¹ Italicized numbers in parentheses identify literature cited in the References at the end of this chapter.

video signals, for example to cable television head ends and to individual backyard satellite receivers in rural areas. Satellite technology is also particularly cost effective for connecting remote locations into national data networks. In the most remote locations, such as in Alaska, satellite connections are also cost effective for voice transmission. For rural telephone subscriber loops, historically served by copper wire, a recently introduced radio service, Basic Exchange Telephone Radio Service (BETRS), costs about one-third as much as copper in many rural applications. Meanwhile, the large installed base of older transmission technology, including copper wire, coaxial cable, and microwave, continues in use and, because the capital costs are already invested, may be cost-effective until the costs of maintaining them at appropriate quality of service levels exceed the costs of replacing them with newer technology.

Because of this complex and changing array of technologies, with different technologies appropriate for different routes and different services, there is no one general technical solution. Technical decisions must continue to be made, route by route and location by location, for the particular services to be offered on that route or at that location. As technology continues to change, the correct choices in the future may be different from the correct choices today.

From the perspective of rural economic development policy, the issue is not what technology to use, but what telecommunications services are available at what price and at what quality levels. The other services using the telecommunications, not the infrastructure itself, generate economic development. Telecommunications services are critical producer services (that is, services necessary for other businesses in the course of their production or marketing). Once the transition to digital switches is complete, those telecommunications services will be provided through software rather than special-purpose hardware. The basic starting point of hardware infrastructure is a digital switch that permits later changes or additions to service capability through software enhancements rather than hardware replacement. The key policy issues concern which telecommunications services will best serve rural economic development goals and which incentives, if any, will be necessary to put in place a rural infrastructure suitable for those services at an affordable cost.

Rural Competitive Advantage

The change in communication technology permits export of information-based services from rural areas, thus contributing to rural job growth, but it also permits the import of information-based services from other areas, which may lead to some local job losses. Rural areas traditionally had economic advantages in agricultural land and natural

resources unavailable in urban areas. Urban markets were therefore willing to pay the necessary price associated with the rural disadvantage, more time delay and higher transportation costs than with urban goods and services.

During the 1960's and 1970's, nonmetro manufacturing enjoyed a brief boom, based on lower costs (primarily labor costs) than in metro areas. But the 1980's saw a reversal of that brief advantage because of foreign manufacture with even lower labor costs and more automated domestic urban production. With agriculture now accounting for only 9 percent of nonmetro jobs and with agriculture, resource extraction, and manufacturing all in continuing decline as a source of rural jobs, the rural economy must look elsewhere for the expansion of rural job opportunities.

The services sector accounts for more than 65 percent of rural jobs (9). Some of those jobs are in physical services, such as restaurant work or hairdressing, but most are information intensive, including banking, education, health services, and various business and government information services such as accounting and computer services.

Most information services jobs depend on reliable, modern telecommunications capability, including voice, facsimile document, and data transmission. If telecommunications facilities are adequate, those jobs can be located almost anywhere. Thus, rural areas can compete for business previously located in urban areas. But, rural information services jobs may also be lost to urban information services. Telemarketing, insurance, and credit card processing jobs are examples of jobs that have moved to nonmetro areas with good telecommunications facilities. Some rural bookkeepers may have been replaced by urban-based computerized accounting services. (However, a rural business that laid off the bookkeeper in favor of an automated system may in the process have saved other jobs that would have been in danger from other competition had it not achieved the productivity gains of the new system.) The trend toward more automated information services thus cuts both ways. Large corporations may provide centralized services for rural branches from urban locations, or corporate administrative functions may be relocated from urban to rural areas. Rural entrepreneurs with access to adequate telecommunications facilities could, thus, compete in a much larger market without being restricted to the local area, but they would also be subject to competition from outside the local rural area.

Many advances in urban telecommunications services are not yet available in all rural areas, including single-party lines, touch tone features, extended area service options, competitive long distance services, and service quality sufficient for fax and data transmission. This difference between urban and rural areas has substantially changed the rural competitive advantage. In

most urban areas party lines are a relic of the past. In rural areas, about 12 percent of households have no telephone service at all, and about 7 percent of available phone lines are on multiparty service. In urban areas, the availability of single-party touch tone service is taken for granted, for example in using an answering machine remotely when retrieving messages. In many business transactions, telephones are answered by a voice recording that requires the caller to use touch tones to get connected to the correct department or telephone extension. Locations without line quality sufficient for reliable facsimile and data transmission are now unsuitable for most businesses. Rural areas without good quality single-party touch tone telephone service may be doomed to economic stagnation.

Call forwarding and call waiting services are useful productivity and access tools for small businesses and are usually easy optional add-on services once basic touch tone service is available. Unlike large companies with extensive optional features available through the company PBX (private branch exchange), small businesses with one or two phone lines will either get such services from their phone company or not at all. Thus, such features may be potential contributors to rural development where small rural businesses find such features useful. Telephone companies will probably make such services available wherever there is demand, once the basic threshold of single-party touch tone service is crossed.

The advantages of modern telecommunications service are not limited to information-intensive businesses. Even rural businesses based on resource extraction need good telephone and facsimile links to distant corporate offices or distant markets. Rural areas with modern telecommunications services will be able to compete with urban areas on a more level playing field. Telecommunications can bridge over the rural distance penalty. Services can be made available over toll-free numbers from rural areas as easily as urban areas once the appropriate technology is available at the rural telephone switch.

The installation of infrastructure by itself does not guarantee economic development; that depends on the uses made of the infrastructure. The infrastructure does, however, create an opportunity for more jobs than would otherwise be possible. Those jobs are more likely to be services and information-processing jobs than jobs involving physical production of goods. Infrastructure is a necessary complement to other economic activity, including those involving both blue collar and white collar jobs. Telecommunications infrastructure is essential for rural economic advances, because not many businesses could be started in or relocated to places without the necessary infrastructure.

Deregulation

U.S. telecommunications policy changed substantially during the 1980's, as competition has been introduced into the industry, with the old Bell system monopoly broken into seven regional telephone companies providing local services and a smaller AT&T, which now competes with MCI, US Sprint, and other carriers for long distance business. As regulatory obligations of telephone companies are reduced and competition is increased, the pressures for cost-based pricing on each route and service are increased. Rural areas, which have benefited from nationwide rate averaging and the resulting cross subsidies, are now threatened with substantially higher prices and a widening gap between the quality and variety of urban versus rural services. Coming at a time of increased economic dependence on the telecommunications infrastructure, this widening gap can doom rural areas to economic stagnation. The same competitive forces that are providing improved and enhanced urban telecommunications services could compound the already severe economic problems of rural areas, unless there is timely and appropriate policy intervention by either or both telecommunications and rural economic development policymakers.

Rural telephone subscribers, like their urban counterparts, now pay access charges, typically \$3.50 per month, on their local phone bills. This regulatory change was part of the change to a policy of encouraging competitive long distance telephone services. Most rural subscribers, however, do not have a choice of long distance carriers and thus do not get the full benefit that was the purpose of the policy in the first place. If the current nationwide average pricing structure for long distance telephone services were replaced by location and route-specific pricing, those rural areas without competitive carriers would probably face the largest increases.

The Federal Communications Commission has ordered that nationwide interstate long distance rate averaging be maintained, but there are increasing pressures for each element of the telecommunications business to stand on its own without benefit of subsidy from averaged rates. On April 1, 1989, the FCC permitted the Bell telephone companies to withdraw from the organization established to maintain nationwide average rates, even though they are still required to make some payments to support smaller independent rural telephone companies. For intrastate calls, which are not under FCC jurisdiction, there are increasing pressures to move away from averaged long distance rates, thereby reducing the traditional form of support for rural telephone service.

Small rural telephone carriers, surviving on the fringes of the national telephone network, compare their plight to that of the last person in the

children's game of crack the whip; policies that ripple past those in the middle of the market have exaggerated whiplash effects on those at the end.

Theoretical Basis for Investing

There are three basic reasons for making or stimulating investment in rural telecommunications beyond the level of investment that the private sector of the economy would make in the absence of policy intervention:

- (1) To achieve economic growth that otherwise would be lost to the economy because the economic benefits are what economists call "externalities," which are benefits that cannot be captured through the prices charged to users by service providers;
- (2) To compensate rural areas for the recent telecommunications regulatory policy changes that reduce the cross-subsidy from within the telecommunications industry that previously was available to help support rural telephone service;
- (3) To provide rural residents and businesses with an opportunity to participate in the national economy that is about equal to that available to urban residents and businesses.

The theoretical basis for the first reason is an economic efficiency rationale. According to standard neoclassical economic theory, when the two key market assumptions of perfect competition and perfect information are met, the private sector of the economy, through its own automatic process, will result in a level of investment that is optimal for the economy as a whole. When buyers have perfect information about the benefits to them of the goods or services offered and when competitive pressures drive the prices to an optimally efficient price, then users will buy (and suppliers will provide) exactly the optimal amount of the goods or services in question. These assumptions are obviously not met in the case of telecommunications infrastructure. Companies providing local telephone service, including connections between telephone users and long distance companies, are all regulated monopolies in the United States. There is no theoretical basis for believing that such regulated monopolies invest in the optimal amount of infrastructure, as judged by standard economic efficiency criteria. Both overinvestment and underinvestment may occur, based on different assumptions about the incentives or disincentives created by the regulatory structure.

The economic optimum, from the perspective of the economy as a whole, would be achieved when the range of services available at every location is such that incremental revenues match incremental costs, provided that the supplier can capture in its prices the economic benefits of making the supply available. In the case of telecommunications services, the suppliers of the service cannot capture all of the economic benefits because some of the benefits accrue to parties not paying for the call, including not only the originator or recipient of the call, but also third parties not directly involved in the immediate conversation or transaction because the fundamental nature of information transactions is different from transactions involving physical goods and services. People who obtain information may pass it along to others without necessarily being deprived of the use of it themselves.

Telephone companies understandably do not tend to take into account indirect benefits when deciding how much to invest in telecommunications and where and when to upgrade facilities. The companies must base such decisions exclusively on anticipated revenues. Telecommunications networks should be considered part of a community's basic infrastructure, along with road, water mains, and electrical power grids, which are justified in part on the basis of their importance to economic development and quality of life. Because of the externalities involved, there is a substantial underinvestment in telecommunications in relation to the amount that would be optimal for economic growth.

Telecommunications infrastructure is theoretically similar to transportation infrastructure, such as highways, with two exceptions. One exception results from the peculiar properties of information cited above, which results in greater externalities in the case of information. The other is the higher cost of collecting user fees for access to highways. In electronics and highways, substantial economic and social benefits come from having a shared infrastructure that all can use. In electronics and highways, a collective decision needs to be taken to ensure that appropriate infrastructure is available for all to use. The high cost of collecting user fees for access to roads creates a wider discrepancy between what would be invested in private toll roads without public intervention and what is optimal for the economy as a whole, than is the case in telecommunications. Nevertheless, the external benefits of telecommunications not captured by the telephone carriers result in private sector underinvestment compared with what is optimal for the economy.

The private sector, with substantial assistance from regulators and rural development programs such as the REA's telephone loan programs, has built a nationwide two-lane electronic road system. But such a network is not necessarily more optimal than the multilane electronic/optical interstate

telecommunications network for voice, data, and video information services that could be provided with some additional policy intervention.

A regulated monopoly structure with nationwide rate averaging was used historically to help support rural areas. The FCC has allowed the Bell operating companies to avoid nationwide averaging (although they must still make some support payments to other carriers under a complicated formula). Rate averaging is no longer required in some States for intrastate calls. The result is likely to be less investment in rural areas, unless a sufficient compensatory mechanism is established. This changed regulatory situation exacerbates the rural underinvestment problem cited above and underlines the urgency of dealing with the issue.

The theoretical basis for the third investment reason is a social equity, rather than a pure economic, argument. Public investments in human capital, for example in education, are justified in part as economic investments and in part as social fairness necessary to provide a fair opportunity for all citizens to participate in the economy and other aspects of the society. Education does not guarantee the later economic success of every child educated, but it is intended to provide equality of opportunity. Investment in rural telecommunications will not guarantee the economic success of every community or household served, but it provides an opportunity to participate more fully in the national economy. Communities without at least basic modern telecommunications service, defined as single-party touch tone service, may be left out because they will not have the same opportunity to compete.

If these investment decisions are left entirely to the private sector to serve without additional public incentives, rural areas are likely to be underserved. Unless there is a strong probability of rural economic development taking place, investment in rural telecommunications infrastructure may be risky. If the infrastructure investment is not made, however, economic development will probably not take place. That investment decision cannot be made at the level of individual rural businesses, because it is a community decision made by telephone carriers, with or without governmental participation. Thus, rural telephone carriers are placed in a awkward position and may need some governmental support. The lower traffic density in rural areas makes the costs higher and the investment riskier than would be the case in urban areas where the higher density and consequent lower average cost is such that government intervention may not be necessary. The risk arises because telecommunications, like other infrastructure, is an enabling factor which is necessary but not sufficient for economic development. If the economic activities making use of the infrastructure are not developed, then the infrastructure investment may not result in the intended benefits.

Empirical Basis for Investing

Research over the past decade has shed considerable light on how telecommunications contributes to economic development. Empirical evidence supports many of the theoretical arguments cited above. A recent review of that research reached the following eight conclusions (9):

- (1) Investment in telecommunications contributes to economic growth.
- (2) Both residential and business telephones contribute to economic growth.
- (3) The indirect benefits of telecommunications generally greatly exceed the revenues generated by the telecommunications network.
- (4) Rural and remote areas, where distances are greater and telephone penetration is generally lower, may benefit most from telecommunications investment.
- (5) Telecommunications acts as a complement in the rural development process; that is, other conditions must also exist for telecommunications to yield maximum development benefits. Without economic activities using the infrastructure, the potential benefits will not be achieved.
- (6) Use of telecommunications can improve the quality and accessibility of education, health care, and other social services, usually at lower unit costs than would otherwise be possible for comparable services.
- (7) Telecommunications can help a wide range of rural businesses and organizations improve productivity, boost product quality, provide more efficient services, and reduce costs.
- (8) Telecommunications can foster a sense of community and strengthen cultural identity, contributing to development in intangible but important ways.

The indirect benefits of telecommunications for rural businesses and social services have been documented by several studies (3, 4, 5, 6, 10, 12). These and other studies show that the measurable benefits of telecommunications exceed their costs (that is, revenues to telephone companies) by many times.

Benefit/cost ratios range from 5 to 1 to more than 100 to 1, based on improved efficiency in managing rural enterprises. Costs are higher in rural areas, but the benefit/cost ratio was substantially higher in more remote areas. Most of these studies, however, were based on the benefits of providing telephone services where none previously existed. The benefits of improving service once it is available are more difficult to measure, but they are probably much smaller.

Fewer than 200,000 U.S. households do not have any telecommunication service available because of geographic location. Thus, our focus of attention is more on bringing services in rural areas up to comparability with urban areas to avoid an additional rural competitive disadvantage. As facsimile and data transmission become essential to business transactions, quality of telephone service sufficient to support such transmissions is particularly important. The difference between good and poor line quality for data transmission on standard voice telephone lines is primarily a difference between 9,600 bits per second compared with 1,200 bits per second of transmission capacity, a difference of eight times in cost to and time spent by the business user.

In areas with expanding population and in areas adjacent to metro areas (which are often the same areas), there is obviously more need for additional communication facilities and services but probably less need for policy intervention to provide additional incentives for investment beyond what the private sector will provide in any event. Expanding near-metro areas will have a higher density of telephone traffic requirements and thus be profitable for the private sector to serve, without government intervention.

One can reasonably assume that telecommunications investment will be more effective in locations where the development emphasis is on the services sector, especially producer and export services (compared with manufacturing, extraction, or agriculture) or where the emphasis is on high skill, high wage jobs (compared with lower skill, lower wage jobs). Nevertheless, no empirical evidence was found to address this issue, one way or the other. Because of the large increase in the information components of agriculture, manufacturing, and extraction industries and the need for close links to suppliers and markets in all businesses, no noticeable difference may exist between areas with information-intensive jobs compared with areas with jobs having a higher component of physical labor.

Different rural economic and social activities depend on telecommunications networks to different extents. Manufacturing businesses are more dependent than ever before on facsimile and data transmission. Agriculture may need to shift to greater specialization and market emphasis to regain global competitiveness. Such a shift would require better telecommunications links

to markets and potential markets. Services, particularly producer and export services, depend greatly on telecommunications.

Even local physical services depend on telecommunications for scheduling. Tourism is an attractive economic opportunity for some rural areas, but tourism-based businesses need voice, data, and video services for reservations, for use by visitors, and for hotel entertainment services. Small businesses particularly depend on enhanced telecommunications services as productivity tools. Transportation, a major problem in rural areas, depends on telecommunications for scheduling and administration. Rural education and health care depend on good telecommunications facilities to link them to specialist teachers and physicians not available locally.

Upgrading major networks as a timely response to immediate demand is difficult, because of the lead times involved. Unlike customer premises equipment that can be obtained quickly as needed, network changes often must anticipate demand, otherwise the potential businesses may locate where adequate infrastructure is already in place. Blue Cross of California recently considered moving its clerical and administrative operations to a rural California community, but was unable to do so, in part because the telephone company serving that community was unable to upgrade its facilities in a timely fashion.

No known telecommunications investments have been bad economic decisions. That there have been no defaults in the 40-year history of the REA telephone loan program is powerful corroboration of that absence of poor investment. In rural Alaska where the distances and costs are enormous and the population density particularly low, rural telecommunications were provided because of political pressures and State government intervention, rather than because the telephone company saw great economic opportunity. Nevertheless, the investment turned out to be economically sound, because use greatly exceeded the most optimistic projections (2).

Rural Telecommunications Infrastructure Today

The U.S. rural telecommunications infrastructure today lags the urban infrastructure in several respects. Even more disturbing is that services are being improved faster in urban than in rural areas. Because of the large fixed costs of telephone service, the loss or potential loss of large customers using private networks rather than the public switched network could mean higher costs for everyone else.

The first important measure is the availability of voice telephone service. According to data collected by the U.S. Bureau of the Census for the FCC,

about 93 percent of U.S. households had telephone service in 1990. Most of the remaining households lacked service because of poverty, rather than because service could not be offered at that location. This national average of 7 percent of households without service was not spread evenly over urban and rural areas, however. In rural areas, 12 percent of households were without telephone service. Most of those households lacked telephones because they were too poor to pay for them. Nevertheless, nearly 200,000 rural households who could afford telephone service lacked it because their rural location makes service unavailable.

A second important measure is the availability of single-party lines. As of 1987, more than 3 million subscriber telephone lines were multiparty, rather than single-party lines. Among rural telephone carriers supported by the Rural Electrification Administration's telephone loan program, 6.6 percent of the subscriber lines were multiparty, compared with 1.2 percent of the lines in the Bell system, which has fewer rural subscribers. Party lines do not permit private voice conversations or reliable data or facsimile transmission. In some cases, party lines still exist because subscribers prefer the lower prices charged for such service. Although accurate statistics are not available to quantify the conclusion, many, probably most, of those party lines exist because no other choice is available in those service areas.

Many important telephone services that urban dwellers take for granted, and which are important for many businesses, include touch tone dialing, custom calling services (such as call waiting, call forwarding, and threeway conference calling), and access to competitive long distance carriers. These services require stored program control at the central office switch and can be available only on systems using digital switches and some late model analog switches with the stored program control feature. Some of these features (beyond basic touch tone service) may be optional frills for residential services and, for large companies, may be alternately available through customer premises equipment such as PBX's. Nevertheless, small business owners, both urban and rural, who can ill afford to miss incoming business calls, often transfer calls from work to home when they leave their normal place of work. Call waiting features allow them to handle incoming calls, even when they have only a single phone line which is in use at the time of the new call. These small business productivity features are unavailable to small businesses when not offered by their phone company.

The number of digital telephone exchanges can be used as a reasonable approximation of the number of telephone exchanges offering modern "digital" services. Among the small rural telephone carriers that borrow from the REA, 32 percent of their exchanges were digital by the late 1980's, compared with more than 50 percent of the top 10 independent telephone companies. Within the Bell system, 34 percent of their exchanges were

digital (presumably those in their major metro service areas). Thus, policies intended to promote rural telecommunications development need to address incentives for Bell operating companies and large independents as well as the REA-supported small telephone carriers.

Another important measure of telephone service is the quality of the lines. Line quality below specification may not be absolutely critical for some voice conversations because the parties may talk louder to compensate or repeat what was not heard because of a burst of noise. Such problems are more severe for data and facsimile transmissions, which are now becoming critical for many businesses. A 1986 REA survey found that about 12 percent of rural subscriber lines in their sample were below REA specifications. REA officials point out that many of the failures of lines to meet their specifications do not affect service, by which they presumably mean that local voice telephone conversations can still be held without difficulty. They have not, however, suggested that the standards are set too high. Advantages of meeting the REA standards include less susceptibility to cumulative noise on long distance calls and more reliable facsimile and data transmission. The REA study did not count the problems resulting from substandard trunk lines that reduce quality on all calls going beyond the local exchange. Data on quality of lines for non-REA borrowers are not publicly available.

Because of greater distances and more time spent on roads, mobile cellular telephone service will probably be particularly valuable for rural areas. The growth of cellular telephone service has been strong in urban areas since service started in 1984. Rural areas do not yet have service because the FCC licensing process for cellular radio telephone service in rural areas just began in 1988. Because of the lower population density in rural areas, additional investment incentives may be necessary to provide service in those areas.

Most rural areas have some form of telephone service, but many rural areas substantially lag urban areas in quality and variety of services at a time when the quality and variety of services is particularly critical to the economic development of rural communities.

Investment Effectiveness and Efficiency

Communications investments, for the 65 percent of rural locations without digital telephone switches and thus not already provided with modern telecommunications services, will be most effective in those locations where individuals or organizations are likely to make economic or public service use of the services. The economic and social benefits of

telecommunications, like highways, flow not from the electronic, or physical, highways, but from the goods and services transported over those networks.

Telecommunications investments will probably be effective in leading to economic development in two circumstances. One is where there is reasonable likelihood that private sector entrepreneurial activity will use the telecommunications to create economic benefits. The other is where development activities, governmental or otherwise, are planned and the telecommunications infrastructure is planned as a necessary complement of other economic development programs. Because of the complementary infrastructure nature of telecommunications, it is necessary, but not sufficient, for economic development and does not come with guarantees. Nevertheless, no U.S. examples of poor or ineffective telecommunications investment are reported in the research literature on this subject, and there are examples of development being blocked by the absence of adequate telecommunications.

The problem of selecting locations, in the event that a policy decision is made to leave some communities or regions without modern service, is that only the very largest business organizations can afford to put in their own private telecommunications. All small and medium-sized organizations must depend on the public infrastructure of the telephone network. Thus, those firms will start, expand, or relocate their business only in locations with adequate service. Other locations will not be considered.

There are no very good mechanisms to coordinate telephone infrastructure investment with other private and public investment. Because of the lag times involved in putting appropriate telecommunications networks and switches in place, businesses are not likely to wait for the service, but will locate elsewhere instead. Without reassurance of potential business use or other investment incentive, telephone companies may underinvest in facilities, thereby exacerbating the problem. Even when several small businesses request a service requiring digital switching, for example, telephone companies may not see enough aggregation of business to justify the short-term investment.

Arguing that the most promising locations are those with the best opportunities for developing information-based services, such as telemarketing or insurance processing, would be a mistake. All economic activities, including agriculture, manufacturing and extraction industries, have a large information component which is becoming more critical to their economic health. These information activities within noninformation businesses are becoming critical to the management and marketing of all goods and services (9, 10, 11).

Few, if any, publicly available U.S. studies of benefit/cost ratios measure the efficiency of specific rural telecommunications infrastructure investments. Microeconomic studies of rural telecommunications investments in other parts of the world show favorable benefit/cost ratios ranging from 5 to over 100 (5, 11, 13).

Few definitive macroeconomic studies have measured the effects of telecommunications investment, despite the large number of studies confirming the high correlation between telecommunications infrastructure and economic activity. A key study by Hardy first demonstrated a significant causal connection between the level of telecommunications available in one time period and the level of national economic development, measured by gross domestic product (GDP), in a later time period (1). Prior studies had shown large correlations between telecommunications investment and the level of national economies but had not been able to unscramble the cause and effect relationships.

Using the same model, another study calculated the indirect benefits of the REA's telephone loan program, which has helped rural telephone companies and cooperatives provide telephone service to about 3 million subscribers. The use of REA-financed telephones contributed \$283 million to the U.S. GDP in 1980. The Government also reaped new tax revenues of \$196 million from REA borrowers and additional tax revenues from subscribers whose income had increased as a result of telephone use. The probable benefits to the U.S. economy as measured by expanded GDP attributable to the REA telephone loan program are six to seven times greater than the Government's loan subsidies (7).

Because of the limited quantity and quality of definitive research evidence, additional research would be desirable. The available body of evidence, however, provides a stronger basis for policymaking than that available for many other policy issues. One can reasonably conclude from the available evidence that investment in rural telecommunications infrastructure is one necessary component of successful economic development programs. Nevertheless, investment in infrastructure alone will not be sufficient to bring about development in locations with insufficient investment in human capital and in local institutional arrangements to support development. The telecommunications investment should be directed at implementing services for rural subscribers comparable to those generally available to urban subscribers and, in particular, bringing single-party touch tone service to all rural subscribers. Such investment will be especially attractive in those locations where economic development is probable because of existing or planned activities, an available labor force, or geographically attractive locations. Locations adjacent to metropolitan areas are also likely to be particularly attractive for telecommunications investment. Because about 65

percent of U.S. rural telephone switches in 1988 did not provide the services generally available in urban areas, the number of such locations is very large.

Policy Options

Policy options may be debated, developed, and implemented in many areas: Federal and State regulatory agencies, Federal and State rural development programs, and Federal and State legislatures.

Federal Communication Commission Options

No further change

Because of the dramatic, arguably traumatic, nature of recent regulatory changes, regulatory inaction may be appropriate, while the industry and its customers adjust to the recently changed regulatory environment.

Discontinue nationwide rate averaging

Some proponents of deregulation and competition argue that telephone companies should closely relate prices to costs for each specific route or location rather than maintain the present system of pooling costs and revenues under nationwide average rates. (As of April 1, 1989, after a change in FCC rules, most larger carriers no longer pool costs and revenues with each other, but still contribute to the cost pools to assist smaller, usually more rural, carriers.) The most likely outcome of such a change would be substantially higher prices for rural areas, while permitting selective lowering of urban prices in response to specific competitive threats, such as loss of revenue to the public switched network from large businesses installing private networks.

Mandate price cap regulation for larger carriers

This option is detailed in the FCC's April 17, 1989, "Report and Order and Second Further Notice of Proposed Rulemaking." Price caps would replace rate of return regulation for larger local exchange carriers. Prices would not be linked directly to costs, quality of service, or the extent to which service is available within each carrier's franchise areas. Instead, carriers would be given incentives to increase profits by reducing costs and would be prohibited from raising prices faster than inflation. The consequences for rural service from electing this option are not known with certainty. Some observers fear that it will result in lowered quality of service, especially for rural service areas.

Permit optional price cap regulation linked to quality and availability of service

Under such an alternative, carriers electing price cap regulation would have lower price caps if they failed to meet agreed-upon schedules for extending the variety and quality of services generally available in their urban service areas to all subscribers throughout their franchise area. Such an alternative could provide a positive incentive for carriers to upgrade service to their rural subscribers within a reasonable time period.

Rural Electrification Administration Options

Disband the REA telephone loan programs

Now that 93 percent of the nation's households have telephone service, although not all have the type and quality of service generally available in urban areas, one could argue that the REA has completed its mission and should be disbanded.

Maintain REA telephone programs at current levels

Maintaining the current level of REA loan programs would provide minimal support for small rural telephone carriers at a time when they will probably continue to be buffeted by regulatory changes that could otherwise hurt rural subscribers.

Expand REA telephone loan programs

This goal would bring rural service, by the year 2000, up to the levels currently available in most urban areas, including touch tone and other digital switch-based services, equal access to competitive long distance carriers, and mobile cellular telephone services. Such a goal would require broadening the REA lending authority and increasing it by about 30 percent to about \$150 million each year. A more aggressive schedule, for example to upgrade rural areas over 5 years instead of 10, would require even more funding.

Federal Rural Development Program Options

No change

This option assumes that no proposed changes are compelling enough to shift from the current status.

Reorganize rural development programs

The current difficulties in coordinating rural telecommunications services with other rural development programs might be alleviated if most Federal rural development programs, including the REA, were integrated into a single rural development organization that could better manage integrated rural development programs and improve coordination of different programs where appropriate.

Add telecommunications authority and funding to most rural development programs

Even without reorganization, expanding the authority of other rural development programs to fund telecommunications applications or infrastructure necessary for the success of their main missions may be desirable.

Telephone/Cable Television Industry Structure Options

No change in legislation

Present legislation, particularly the Cable Act of 1984, restricts competition between telephone and cable television carriers, while keeping the two types of business separate. A limited exception permits cooperation in rural areas. A policy of no change in legislation would still permit the FCC to provide exceptions for rural areas, within the present legislative limits.

Remove legislative barriers to competition and cooperation

Under this option, cable television and telephone companies would be allowed to compete or to merge into a single monopoly service.

Encourage urban competition, but permit rural cooperation

Under this option, cable television and telephone companies would be permitted to compete with duplicate transmission facilities but not to merge into a single local monopoly in urban areas. A broad exception would be granted to rural areas where it may be difficult for even a single network to survive, let alone two competing networks.

State Regulatory Options

Different States have taken different positions with respect to the recent trends toward deregulation and competition. Thus, different situations exist

in different States. Some of the options listed below have been implemented in some States.

Stop averaging intrastate rates

In the interests of competition, some intrastate rates would no longer be based on statewide rate averaging. This change usually benefits urban subscribers more than rural subscribers.

Encourage accelerated depreciation

Accelerated depreciation, particularly of older equipment, provides an incentive to upgrade the variety and quality of services offered, but may lead to higher short-term tariffs, or be an alternative to rate reductions.

Permit intrastate long distance competition

Some States now permit intrastate long distance competition, just as Federal regulations permit interstate long distance competition. Competition could benefit those rural residents with access to competitive carriers but work to the disadvantage of those without a competitive choice.

Permit price cap regulation of intrastate rates

The same options discussed above, under Federal regulation of interstate services, apply to intrastate jurisdictions, except that additional problems may occur if different types of regulation are used in different jurisdictions. The same facilities are used for both intrastate and interstate calls and allocating costs between the two jurisdictions may be difficult to monitor.

Require upgrade of service quality and availability in exchange for deregulation

Many telephone companies, especially Bell companies, are pressing State regulators for less regulation and more flexibility, particularly in the area of competitive information services. This may provide an opportunity for States to enter into a new "social contract" or "incentive regulation" agreement with telephone companies to require them to upgrade the quality and variety of services throughout their entire franchise service area in exchange for deregulation of enhanced competitive services.

State Rural Development Program Options

No change

In some States, the present arrangements may be adequate.

Encourage development agencies to review and support telecommunications programs

Because rural telecommunications complement other rural development programs, most rural development programs would, ideally, fund telecommunications applications in ways that encourage private investment in infrastructure necessary to support development programs.

Provide a centralized State telecommunications policy and planning office

States that have not already done so might consider instituting a State telecommunications policy and planning office to help in coordinating telecommunications activities of various State agencies and programs. Maintaining adequate telecommunications expertise in all State agencies may be difficult, and providing centralized advice and coordination may be less costly.

Local Government Options

Because of the structure of the telecommunications industry and the way it is regulated, few if any options are open to local governments to meet their local development needs other than to plead their case before their telephone carrier and State and Federal regulatory bodies. In rare cases, a local community may be able to persuade a long distance carrier to locate a point of presence in their community to reduce the costs of long distance access. The community would have to convince the long distance carrier that a very high volume of traffic, such as a major national telemarketing venture, would result from such location.

Conclusion

The evidence concerning the relationship between telecommunications infrastructure investment and economic development is such that a compelling case can be made to provide incentives to encourage rural telecommunications infrastructure development. The only exception may be in rural communities that do not wish to have, or are unable to have, any of the economic development activities that could make use of modern telephone services. Telecommunications facilities are the electronic highways of the information age. Communities without access to those electronic highways will be left behind, just as those communities not served by the Federal highway system have been disadvantaged. The gap between rural and urban telecommunications services is widening and may be one contributing factor in the decade-long decline of rural economies. If rural areas are to have the opportunity to compete effectively in the global economy, the rural availability of the telecommunications services currently

available in urban areas may be essential. The minimum requirement is single-party touch tone service with line quality sufficient for facsimile and data transmission, as well as voice communication.

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Chapter 4

Water and Wastewater Investment To Promote Economic Development

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Water and wastewater infrastructure is necessary for health, safety, and economic development. We can estimate the amount of additional investment in water and wastewater infrastructure needed to ensure national health and safety. We cannot estimate the amount needed nationally to promote rural economic development. The relationship between infrastructure and economic development depends on many things. Therefore, we conclude that investment in water and wastewater infrastructure is necessary but insufficient for economic development and that such investment has the best chance for promoting development where the lack of water and wastewater infrastructure constrains development.

As with other types of infrastructure, investment in water and wastewater facilities is often cited as a way to promote economic development. The recent spate of proposed rural development legislation has continued this theme.¹ Such proposals correlate the "dual crises" in our Nation's infrastructure and rural economy by claiming that poor rural economic performance is partially a result of inadequate infrastructure, in this case water and wastewater treatment and distribution facilities.

In this chapter, we explore the relationship between water and wastewater infrastructure and economic development. In so doing, we hope to assess the potential for investments in that infrastructure to promote economic development in rural America. Toward that end, we examine the current condition and future needs of water and wastewater infrastructure in rural America and the theory and empirical studies of the relationship between economic development and water and wastewater infrastructure.

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¹ Of the more than 90 pieces of rural development legislation proposed by the 101st Congress, at least 12 contained provisions dealing with water and wastewater infrastructure.

Economic development is not the only nor perhaps even the primary reason for investing in water and wastewater infrastructure. More than transportation or communications, water and wastewater infrastructure is necessary for public health. Clean drinking water and protection from the health and environmental hazards of waste are basic necessities of life and, therefore, merit provision. Nevertheless, the task at hand is to examine the validity of claims that investment in water and wastewater infrastructure contributes to economic development.

Water and Wastewater Infrastructure Defined

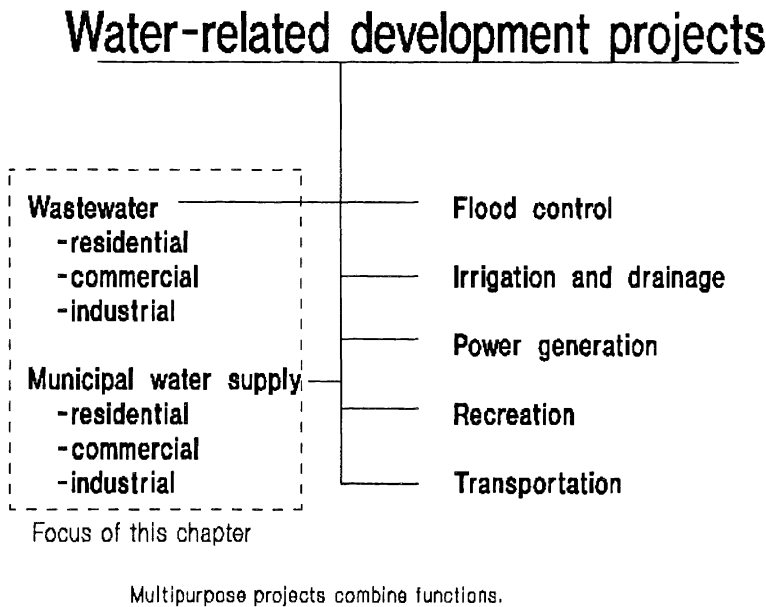
Water supply and wastewater infrastructure provide essential water-related services to homes, industries, and businesses. These infrastructure systems include raw water sources taken from ground or surface water, storage reservoirs and tanks, treatment plants, distribution and collection systems, transmission pipelines, onsite systems such as wells or septic tanks, and support facilities such as laboratories and maintenance forces. Other water-related investments include multipurpose reservoirs, irrigation and farm drainage systems, flood control works, environmental waterway improvements, navigation works, and hydropower facilities. These investments may also contribute to quality of life and economic development in rural areas, but we excluded them from the scope of this chapter because they do not provide direct water and wastewater service (fig. 1).

Current Conditions and Future Needs

Needs estimates are one way of assessing the condition of existing infrastructure. They provide information about the amount of investment in infrastructure needed to bring that infrastructure up to a specific level of performance. However, most needs estimates, including those discussed in this chapter, are not based solely on economic concerns. They do not estimate amounts of additional infrastructure investment needed strictly to maintain or generate economic activity. Some estimates may attempt to include economic needs, but the absence of an established benchmark (such as the absolute level of infrastructure necessary to maintain or generate economic activity) precludes accurate assessment of any shortfall. Rather, these estimates describe the additional investment needed to bring water and wastewater infrastructure up to minimum required levels to ensure health

Figure 1

Types of water-related infrastructure



and safety. As a result, rural infrastructure needs for economic development have not been extensively documented.²

Water Conditions

The U.S. Environmental Protection Agency (EPA) defines "community water systems" as publicly or privately owned systems serving 25 or more people and having 15 or more connections. In 1980, an EPA survey showed some 59,000 such systems.³ Community water systems served 84 percent of the U.S. population, with 71 percent being served by publicly owned systems and

² The National Rural Community Facilities Assessment Survey (NRCFAS) inventoried rural infrastructure; however, those data are now 10 years old. Ryan documented cost estimates of need for public wastewater treatment facilities as reported in EPA's 1988 Needs Assessment Survey (7). Italicized numbers in parentheses identify literature cited in the References at the end of this chapter.

³ EPA's 1986 survey showed 52,509 systems, but the differences are apparently a matter of accounting methods (5, 9).

13 percent by privately owned systems. About 15 percent of the U.S. population is served by private wells; about 1 percent has no water supply. These 59,000 systems include both urban and rural systems. A 1980 survey of rural systems found that over 25,000 rural communities (55 percent of all rural communities) were served by public water service (water service made available to the general public, but not necessarily publicly owned) (8). The remaining 45 percent are served by private wells, small cluster wells, other onsite water supplies, or hauled water. For the most part, areas served by public water systems were incorporated municipalities. Only 38 percent of unincorporated rural areas were served by a public water system.

Water Needs

Water supply needs arise from three factors: maintenance or replacement of existing facilities, construction of new facilities to meet increasing demand, and compliance with regulations such as the 1986 amendments to the Safe Drinking Water Act (11).

After evaluating water supply needs studies that had been prepared by EPA, the American Water Works Association, and the Congressional Budget Office, the National Council on Public Works Improvement concluded that the best estimate of total national capital needs was \$4.5-6.3 billion per year for the next 20 years (11). The exact rural portion of the total national needs is not known.

Of rural water needs, maintenance or replacement of existing facilities accounts for a large portion. In 1980, 18 percent of rural communities had more than 65 percent of their pipelines over 50 years old (8). Engineers typically cite 30 years as life expectancy for water pipes and mains.

The Safe Drinking Water Act adds reporting and treatment expenses to all systems, with heavy burdens on smaller systems. The purpose of the act is to reduce the potential for contamination and thus ensure a safe water supply.

In addition to the 59,000 community water systems, another 145,000 noncommunity water systems serve transient or recreational areas (3). Many of these systems, which serve some 36,000 Americans a year, are located in rural areas. EPA is reclassifying about 20,000 of these--mainly schools, day care centers, and industrial facilities--as community water systems. These systems will then have to comply with the act.

Wastewater Conditions

"Three-quarters of the Nation's 24,141 wastewater treatment facilities are eligible for funding under the Farmers Home Administration (FmHA) loan and grant program" (7). These facilities provide wastewater treatment services to about 32 million Americans. Both metro and nonmetro systems may be eligible for FmHA funding, but eligibility is limited to those systems which primarily serve rural residents.⁴

The average FmHA system operates at 80 percent of design capacity, but 20 percent of all FmHA systems are operating at flows that exceed their design capacity.

Wastewater Needs

To bring existing FmHA eligible facilities into compliance with current performance standards would cost an estimated \$13.7 billion (7). By 2008, another \$4.4 billion (1988 dollars) will be required. Most communities with FmHA systems will need new treatment systems to replace existing facilities which employ onsite disposal. These figures are capital needs only and do not include spending for operation or maintenance.

Relationship Between Water and Wastewater Infrastructure and Economic Development

The relationship between water and wastewater infrastructure and economic development is poorly understood. Whether water and wastewater investments create development or development creates demand for water and wastewater is often difficult to determine. The degree to which water and wastewater investments and economic development affect one another also varies. Adequate water and wastewater infrastructure is generally a necessary but insufficient ingredient for economic development. Without at least a minimal amount of such infrastructure and the services it provides, development may not occur. However, an additional investment in infrastructure will not necessarily yield developmental benefits. Absent other necessary ingredients, water and wastewater infrastructure cannot create development.

As with other types of infrastructure, the economic development role of water and wastewater stems primarily from the services they provide, not from the physical facilities themselves, except for the economic activity generated in the construction and operation of the facilities. Without an

⁴ For a complete list of eligibility requirements, see (10).

adequate supply of clean safe water, the economy of a rural region cannot develop to its full potential. Water is needed for consumption by workers, customers, and their families. Many businesses and industries also require it in their production processes. The same is true for the treatment and removal of waste. These simple needs form the basis of the relationship between water and wastewater infrastructure and economic development.

Service provided by water and wastewater infrastructure meets some of the basic needs of people and business, but does it promote economic development?

Economic development can increase the demand for water and wastewater infrastructure. Growth in an area's population and economic activity expands the market for water and wastewater service as the number of clients increase or the volume of service demanded per consumer increases. In some instances, growth in demand may exceed growth in supply. Thus, inadequate water and wastewater service may constrain further development. Limiting the supply of water and wastewater is, in fact, sometimes used as a growth management tool. Communities wishing to limit development in certain areas may refuse to provide service to those areas, thus effectively preventing construction. Still, the focus of our inquiry is on those communities which face an unintentional constraint on development due to inadequate infrastructure.

Development may also change the character of service demanded. A new production process may, for example, require "high-purity" water or the removal of toxins from wastewater. High technology industries, for example, depend on high-purity water--deionized, thoroughly filtered, and disinfected by some means other than chlorination (11). However, the availability and price of public water supplies is less likely to be an important locational factor for such industries, because their purity requirements exceed those necessary to ensure public health and the volume of water required is low (11). Therefore, such industries treat the available water supply themselves to meet their needs.

In either case, demand for the services provided by that infrastructure has increased as a result of economic development. But is the converse true? Can an increase in water and wastewater infrastructure, or an initial investment where none existed, lead to economic development?

The relationship between water and wastewater infrastructure and economic development can be either direct or indirect. A direct relationship exists when water and wastewater investments generate economic activity directly. An indirect relationship results from investments in water and wastewater which enable other factors to generate economic activity.

Direct Relationship

Direct relationships with economic development stem primarily from the inclusion of water and wastewater services as direct inputs in a production process. Water used in the milling of paper and wastewater treatment of the resulting pollutants are examples. Providing the input in adequate quantity and quality may have two effects; production is enabled where none existed before or the productivity of existing production is increased. Take for example a paper mill. If water and wastewater service were previously unavailable, their provision would enable a new mill to start up. If water and wastewater were already available, but only in amounts which prevented full use of the mill's equipment, expansion of the water and wastewater capacity would enable the mill to increase its hours of operation and thus better use its equipment. In either case, the other necessary inputs to production must be present. The increase in economic output, either through new or expanded production, increases the economic returns to the owner, the employees, and presumably the surrounding community (via increased expenditures in the local economy). The result is economic growth.

Other direct relationships occur as a result of the expenditures made in the local economy during construction and operation of the water or wastewater facilities. Wages paid to the construction workers and purchases of building materials put money into the local economy. However, these contributions are shortrun only. When the construction ends, so do they. Also, construction-related expenditures often are made outside of the local rural economy. Many rural areas may not have a construction company capable of building a large infrastructure project. The financial requirements of building such projects--the overhead on equipment (whether owned or rented) and personnel, the bonding capacity, and insurance liability--often prevent small companies from winning large contracts. Instead, larger companies from neighboring metro areas may win the contract, thereby paying wages to their metro-based workers and buying materials from their regular metro suppliers.

Indirect Relationships

Indirect relationships with economic development stem from the supporting role that water and wastewater play. In the case of an insurance company, for example, water and wastewater are not direct inputs into the production process, but they are necessary to meet the needs of company employees. The effect of water and wastewater provision in this instance is the same as in the paper mill example. Where service was previously unavailable, new production is enabled. Where service existed but in insufficient quantity or quality, production may be expanded. Again, the other necessary inputs

must be present. Although water and wastewater infrastructure, in this example, does not generate economic activity directly, it enables generation by other inputs.

Water and wastewater may also contribute indirectly by enhancing the quality of life in a community. Such enhancements make a community a healthier and often more aesthetically pleasing--and therefore a potentially more productive--place in which to live and work. If all other factors are equal, many businesses are more likely to locate in such an environment. Healthy workers are less likely to miss work and more likely to be productive while at work. One would also assume that both employers and employees would prefer to live in an aesthetically pleasing environment. And finally, given a choice of communities with equal goods, access, and prices, consumers will probably prefer to shop in a clean and attractive community.

The influence on location by water and wastewater infrastructure in both the production and consumption decisions is an indirect contribution to development when the provision of that infrastructure does not remove a constraint in the production or consumption function (as in the paper mill example), but rather merely contributes to the quality of the location.

The effect of water and wastewater infrastructure on locational preference may have been the subject of more research than any other facet of the role of water and wastewater in economic development. The studies generally find positive relationships of varying magnitude between access to a supply of treated water and wastewater treatment facilities and development.

Such research, however, must be interpreted with caution. Surveys of locational factors are potential "wish lists." The cost/benefit ratio of infrastructure investment is also typically unaddressed in the locational factor literature. To assess that ratio, aspects such as the employment and wage generation potential of locating entities must be examined, as well as the cost of provision.

Other Factors Affecting Development

Infrastructure is only one variable in the development equation. By itself, investment in water and wastewater facilities cannot promote economic development. Other factors must also be present. In the paper mill example, other inputs to production--such as labor, pulp, and electricity--were also necessary. Furthermore, providing water and wastewater increased economic activity only inasmuch as the infrastructure shortage was the constraining factor. In other words, provision of water and wastewater service would not allow for expanded output unless sufficient supplies of

pulp were available and there was demand for the additional output. In the insurance example, the factors which were supported by water and wastewater service were requisites. Finally, in terms of quality of life, water and wastewater account for only a portion of that quality. Other facilities and amenities--such as hospitals, parks, and clean air--must be present for a healthy, attractive environment.

The importance of water and wastewater infrastructure in the development equation varies across types of investment, financing methods, industrial sectors, individual production processes, and local conditions. The influence of each of these factors must, therefore, be accounted for in determining the potential contribution to economic development of any water and wastewater investment.

Investment in water and wastewater infrastructure can be for constructing new facilities, upgrading existing facilities to improve services, expanding existing facilities, or maintaining existing facilities. The target of these investments may be water supply, treatment (water or wastewater), water distribution, or wastewater collection. The development effects of each permutation will vary according to the demand they fill.

Contributions to economic development of water and wastewater infrastructure will vary according to the method of finance used. According to Fox, "Rural governments have three ways to finance new capital investments: Federal and State assistance, debt, and own source revenues (taxes and user fees)." Because the cost to the beneficiaries of the infrastructure varies across these options, the net benefit varies, and therefore, the economic development effect varies (2). Even from a national perspective, which allows us to ignore local costs, the national net benefit may vary, as certain financing methods cost more than others.

Because need for water and wastewater varies among industries (for example, manufacturing tends to use more than professional services), the contribution from that infrastructure to the economic development of a community will vary according to the industrial needs of that community. Likewise, if a community has prospects for economic activity in industries needing substantial water and wastewater capacity, then investing in those infrastructures may prove beneficial.

Production processes within the same industrial sector also vary in their use of water and wastewater and thus the contribution of these services to economic development varies.

Other conditions such as the physical environment and demographic patterns of a community will also help determine the effect of water and

wastewater investment because the type and therefore the cost of those investments will vary. For example, a wastewater system (collection network and treatment facility) for a mountainous region of low population density would be very different--due to steep grades, rocky soil, and the need for a more extensive collection system--than a system for a more densely populated lowland community.

Finally, the level and type of existing development will affect the relationship between water and wastewater infrastructure investments and economic development. One hypothesis holds that the effect of infrastructure investment would vary according to the level of development of a region.⁵ One test of that hypothesis found that infrastructure investments had the greatest economic development effect--in terms of gross domestic product--in the intermediate regions of Mexico. Those regions contain large industrial bases, large urban service sectors, well-advanced educational and health levels, and substantial immigration attracted by employment opportunities. Lagging regions (with low standards of living and the predominance of small-scale agriculture or stagnant/declining industries) and congested regions (with high concentrations of population, industry and commerce, and substantial amounts of existing infrastructure) received fewer developmental benefits from infrastructure investment (6). In terms of causality, the study concluded that infrastructure appeared to cause development in those intermediate regions.⁶

Another study found that investments in water and wastewater had a greater effect on manufacturing output in growing regions than in declining ones. In both types of regions, the effects of wastewater were greater than those due to water, and effects of both were smaller than those from highway investments (1).

Type of Development

Development induced by water and wastewater investments, whether directly or indirectly, may take two basic forms: expansive or relocate.

Expansive development stems from the startup of new business or the expansion of existing business within the local community.⁷ As such, expansive development adds to both the local and national economic output. If the value of added output outweighs the cost of the water and wastewater

⁵ The hypothesis was set forth by Hansen (4).

⁶ Caution should be taken in applying these or other findings based on Third World data.

⁷ New business includes firms who are headquartered locally or elsewhere as long as they are new startups (creating a net increase to national economic output) and not relocated.

investment which made it possible, then the investment efficiently promoted economic development.

Relocative development stems from the relocation of a business to the local community. Whereas expansive development adds economic activity, relocative development merely moves economic activity from one community to another. One may, therefore, question whether relocative development is actually development at all. Unless the new location removes constraints that existed in the former location, including access to water and wastewater at a lower cost, and could not be removed there (and thereby increases productivity), relocative development represents no development from a national perspective. In that vein, one should remember that investments in water and wastewater infrastructure (since those same investments can be made elsewhere) by themselves rarely remove such constraints.

Conclusions

Given the estimates of rural water and wastewater conditions and needs, one can reasonably argue that there is underinvestment in that infrastructure in terms of health and safety. However, absent a better understanding of the links between water and wastewater and economic development and more recent and more accurate inventories of rural water and wastewater infrastructure (and other community resources), we cannot say that there is underinvestment in rural water and wastewater in terms of economic development. Hence, we cannot say that nationally distributed investments in rural water and wastewater **will** promote economic development, only that in certain situations they **may**.

What are those certain situations in which investment in water and wastewater infrastructure **may** promote economic development? Investments in water and wastewater infrastructure have the best chance of promoting development in situations where the lack of that infrastructure is constraining development. That is, the other requisites for development (direct, as in a production process, or indirect, as in quality of life) are available, but a lack (in quantity or quality) of water and wastewater has constrained production or quality of life. Beyond the point where investment relieves the constraint, further investment in water and wastewater will lead to diminishing and at some point negative marginal rates of return.

The extent to which the lack of water and wastewater infrastructure acts as a constraint to economic development is difficult to determine and varies widely across communities. There is no evidence that a shortage of water and wastewater facilities is **the** sole rural economic development problem.

That shortage may be a key problem in some (unknown number of) places, but sweeping categorical programs to provide such facilities are an inefficient approach to promoting development. Although many communities would appreciate such assistance, their development needs might be better met with another type of aid. Constraints to development must be determined locally.

Where the lack of water and wastewater infrastructure is a constraint to development, investment in that infrastructure must reflect the complexity of development and the influence of other variables: type of investment made (new construction, repair, or expansion), method used to finance the investment, industrial sector mix of the local economy, individual production process that will use the water and wastewater service as an input, and local conditions such as population density, and terrain.

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